OCTOBER 1951

Save

THE SCIENCE TEACHER

- Atomic Energy for Good
- Atomic & Molecular Models
- An Elementary School Science Laboratory
- The Health Science Club *and* Kitchen Physics
- Paper Chromatography

Dr. Fuller

JOURNAL OF THE NATIONAL SCIENCE TEACHERS ASSOCIATION

THIS MONTH'S COVER . . . pictures the "five-foot book shelf" on atomic energy which has been developed by Associated Universities, Inc., contractor with the U. S. Atomic Energy Commission for the operation of the Brookhaven National Laboratory at Upton, Long Island. Sampling the library are, left to right, Sumner T. Pike, member of the AEC, John Knox of the Associated Press, and Karl D. Hartzell, director, Educational Services, Brookhaven National Laboratory. The book shelf is a traveling library which is available on request without charge. Further suggestions as to educational services in the field of atomic energy are given on pages 188-189 of this issue of *The Science Teacher*.

Guided Missives

Dear Mr. Carleton:

It is of interest to me to keep up as an active member of NSTA. Last year I was in China, but since it seemed wise for Americans to withdraw, after a few months in the United States I was transferred to our Episcopal High School here. Alas! Neither the government nor the mission is supplied with much equipment. It is curious that the primitive tribespeople here see and use airplanes without ever having a wheeled vehicle. Roads are coming, but previously everything was head carrying. We do need to go into advanced mechanics without ever covering the steps leading up. We are trying to emphasize agriculture so that they may feed themselves, but without even farm animals it is too hard—so we need to understand tractors.

I am wondering what happens to the exhibits after the students put them in the science fairs and whether some bit of exchange (biological specimens not allowed) might be possible with our students here who have so few materials to work with.

Packages coming to us take several months and some specimens are liable to deterioration, but certain of the small physics and chemistry exhibits would be helpful.

Liberia looks to America for help—but every word of race prejudice is relayed to us. I was glad for the article in the *Reader's Digest* for July, 1951, by Mr. Schuyler.

CATHERINE C. BARNABY
Science Teacher, Episcopal High School
Robertsport, Liberia, West Africa

EDITOR'S NOTE: We're confident Miss Barnaby's request will not go unheeded. It suggests a worthy activity for a science club.

Dear Sirs:

The NSTA offers teachers of the science fields one of the finest services with which I have come in contact. I would like to personally thank all persons responsible for the fine packets and other services rendered.

CHARLES P. DEATON
Macon, Georgia

Coming . . .

in the November issue of The Science Teacher

- Emphasis on earth science—articles, teaching suggestions, sources of help
- "What the Ideal Chemistry Course Should Be"
- "Mock-Ups in Teaching Science"
- Suggestions for elementary-school science

THE SCIENCE TEACHER

The Journal of the National Science Teachers Association, published by the Association, 1201 Sixteenth Street, N. W., Washington 6, D. C. Membership dues, including publications and services, $3 regular; $6 sustaining; $2 student (of each, $1.50 is for Journal subscription). Single copies, 50¢. Published in February, March, April, October, November, and December. Editorial and Executive Offices, 1201 Sixteenth Street, N. W., Washington 6, D. C. Copyright, 1951, by the National Science Teachers Association. Entered as second-class matter at the Post Office at Washington, D. C., under the Act of March 3, 1879. Acceptance for mailing at Special rate of postage provided for in the Act of February 28, 1925, embodied in paragraph (d), Section 34.40 P. L. & R. of 1948.

OFFICERS OF THE ASSOCIATION

MEMBERSHIP

The membership year coincides with the calendar year. An introductory membership is available each year for the period September through December for the special rate of $1.

Active Membership	$3.00
Sustaining Membership	$6.00
Student Membership	$2.00
Library or Elementary School	$3.00
LIFE Membership	$100.00

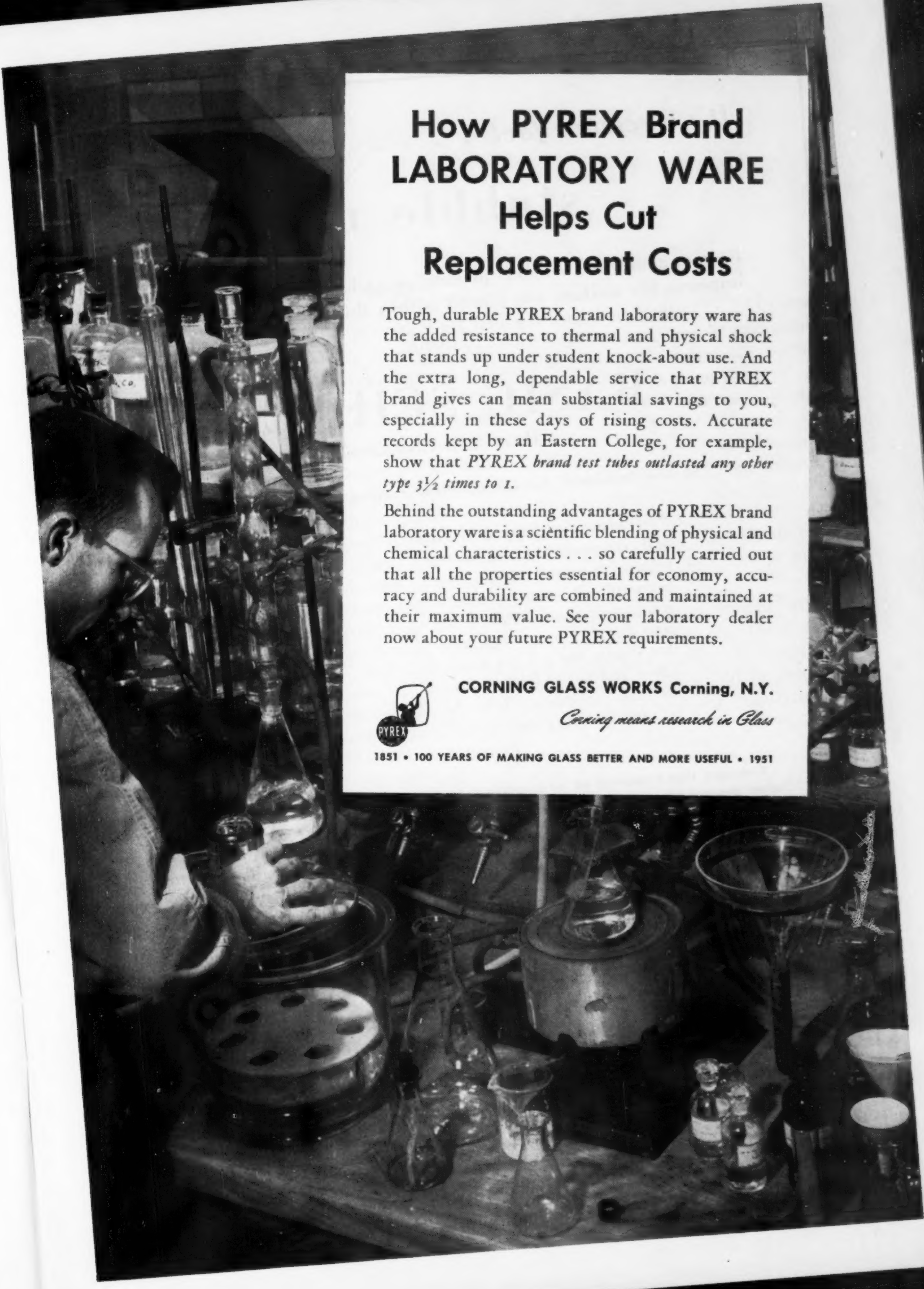
(Payable in annual installments of $10.00)

Please mention THE SCIENCE TEACHER when answering advertisements.

THE SCIENCE TEACHER

Vol. XVIII, No. 4 October, 1951

The National Science Teachers Association is a Department of the National Education Association and an Affiliate of the American Association for the Advancement of Science. Established in 1895 as the NEA Department of Science Instruction, the Association later became the American Council of Science Teachers. It merged with the American Science Teachers Association and reorganized in 1944 to form the present Association, and **The Science Teacher** became the Official Journal of the new National Science Teachers Association.


How PYREX Brand
LABORATORY WARE
Helps Cut
Replacement Costs
Tough, durable PYREX brand laboratory ware has the added resistance to thermal and physical shock that stands up under student knock-about use. And the extra long, dependable service that PYREX brand gives can mean substantial savings to you, especially in these days of rising costs. Accurate records kept by an Eastern College, for example, show that PYREX brand test tubes outlasted any other type 3½ times to 1.
Behind the outstanding advantages of PYREX brand laboratory ware is a scientific blending of physical and chemical characteristics . . . so carefully carried out that all the properties essential for economy, accuracy and durability are combined and maintained at their maximum value. See your laboratory dealer now about your future PYREX requirements.
PYREX
CORNING GLASS WORKS Corning, N.Y.
Corning means research in Glass
1851 • 100 YEARS OF MAKING GLASS BETTER AND MORE USEFUL • 1951

Editorial

What Is Required to "Flunk" a Subject?

The September *Reader's Digest* carried an article telling how badly "U. S. College Students 'Flunk' Geography." We leave the answer to this charge to our colleagues in social studies, although we suspect part of the answer may be found in the second paragraph of Dr. Gallup's little essay on the inside back cover of the same issue.

Sticking to our own last, what must the students do to "flunk" in science? Would failure to remember and recite the facts be sufficient?

No argument, though; the facts *are* necessary. But what is the important, *long-range* residue to be expected from science instruction? "Air is 20.78 per cent oxygen; an insect has a head, thorax, abdomen, and six legs; $3Cu + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$; average pressure on a submerged vertical surface equals $\frac{1}{2}HD$?" Or, do we hope for insights and understandings of scientific principles, ideas, and the methods of scientists, plus facility in their use to explain and predict phenomena and in meeting successfully some of the problems of daily living?

Any assumption that knowledge of the facts automatically assures insight, understanding, and ability to use is difficult to defend—or to refute. Facts *plus* these other qualities are acceptable goals of instruction, but we know how easily the facts slip away from us even though they once were learned. Nevertheless, it would be interesting, and of tremendous value, to delve into the scientific literacy of our population.

NSF—In Business or Out?

When the National Science Foundation was established last year the Congress set a ceiling of 15 million dollars on its annual authorization. In developing this year's request for 14 million, NSF under the direction of Dr. Alan T. Waterman had proposed eight million to support basic research and five million for 2100 graduate fellowships.

In late August the House Appropriations Committee cut the NSF request from 14 million to $300,000. As of this writing the House has approved the committee's recommendation. Obviously such a reduction, should it stand, would be tantamount to putting NSF out of business.

In one of its Public Service advertisements, International Latex Corporation calls the House Appropriations Committee action "the 'Believe It or Not' Congressional error of a generation." Certainly one cannot help but wonder how well some of our leaders understand the nature of the scientific enterprise and the role of scientists in our modern industrial society.

ROBERT H. CARLETON

ATOMIC ENERGY FOR GOOD

This article brings up-to-date information on some uses of atomic energy in a research area that may be new to many of us. Late last spring Dr. Subarsky took a day off from his teaching at the High School of Science, New York City, where he is chairman of the biology department, and went to "see for himself" some of the things going on at the Brookhaven National Laboratory. This story, based on part of his observations, should help bring a modern flavor to science teaching this fall. Dr. Subarsky's interest in helping reduce the lag between classroom and the cutting edge of science has also been displayed in his four year's membership on the NSTA Advisory Council on Industry-Science Teaching Relations.

By ZACHARIAH SUBARSKY

THE title of this paper was deliberately worded to have a double meaning. First, atomic energy is here to stay, and we might as well make up our minds to live with it. Second, atomic energy is even now being put to beneficial uses.

Some of the beneficial uses of atomic energy have been much publicized. For example, it is now widely known that atomic radiations are being used in the treatment of certain forms of cancer and that tracer techniques are being used to elucidate chemical mechanisms involved in dynamic chemical and biological systems. In this paper a lesser-known but highly promising beneficial use of atomic energy will be described—one that the science teacher will want to bring to the attention of his students. But first, with apologies to the already initiated, some "elementary" background information will be presented.

Atomic radiations emanate from unstable atoms, for example, atoms of radium. These radiations are regarded as fragments of atomic disintegration. The study of such fragments has led physicists to postulate that at least three fundamental constituents go to make up the atoms:

(a) the *proton*—a particle that has relatively great mass and is electrically charged positive (+)

(b) the *neutron*—a particle that has great mass but no electric charge (neutral)

(c) the *electron*—a particle that has hardly any mass, comparatively speaking, but is electrically charged negative (—)

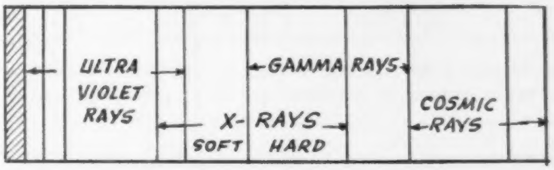
Protons and neutrons, tightly packed, constitute the dense nuclei or cores of the atoms, while electrons revolve about the nuclei at distances which, on an atomic scale, are very great. When there is a proper balance between neutrons and protons in the nucleus of an atom, the atom is stable. When there is an imbalance, the atom disintegrates; protons, neutrons, or electrons shoot out at great speeds. These particles, plus certain others, constitute the so-called atomic radiations.

However, protons, neutrons, or electrons do not always come out of an atom separately. Sometimes the particles emerge in identifiable combinations. For example,

(d) the *deuteron*—a particle consisting of a single proton combined with a single neutron and therefore electrically charged positive (+)

(e) the *alpha particle*—a particle consisting of two protons and two neutrons—all four combined—and therefore electrically charged positive (2+)

Moreover, a nuclear disintegration may give rise to gamma rays. As shown in the illustration below, "the gamma ray" corresponds to a range of radiations or waves in the electromagnetic spectrum. Gamma rays are really closely allied to the X rays but have even greater penetrating powers.



A disintegrating atom, then, can yield protons, neutrons, electrons, deuterons, alpha particles, or gamma rays. In the nomenclature of atomic physics a stream of alpha particles is called an *alpha ray* and a stream of electrons is called a *beta ray*. Alpha, beta, and gamma rays were first studied and identified as emanations from radium.

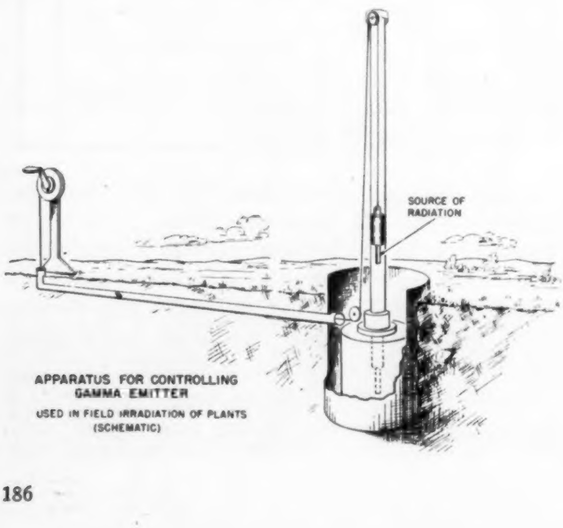
Atomic physics has now advanced to the stage where each of these rays can be produced by suit-

able treatment of atom fragments in accelerators (cyclotrons, betatrons, etc.) or by the treatment of atoms in the atomic pile. The nuclei of stable atoms can be unbalanced by directing atomic radiations against them, thus rendering such atoms unstable (radioactive). Materials thus made radioactive give off radiations of their own.

One of the radioactive materials produced in an atomic pile (now commonly called a nuclear reactor) is cobalt-60. Co^{60} has a half life of 5.3 years. As it comes from the pile, Co^{60} has a specific activity of 48 millicuries per gram. In the vernacular of the atomic scientist, cobalt-60 is "hot stuff."

To study the effects of atomic radiation on plants, this arrangement was designed: In the center of a three-and-one-half acre field a hole is dug in the ground. Into this hole a cylindrical lead chamber is buried. The walls of this chamber are eight inches thick. Connected to this chamber, as shown in the next illustration, is a steel pipe. A mass of radioactive Co^{60} is attached to a lead weight and suspended from a cable in the pipe. The other end of the cable is made to run around a system of pulleys and through a pipe in the ground leading to a safe distance from the center of the field. This end of the cable is wound around a crankshaft. By turning the crank, the cobalt in the center of the field can be raised in the pipe to a desired height above ground level or lowered into its lead chamber below the surface of the ground.

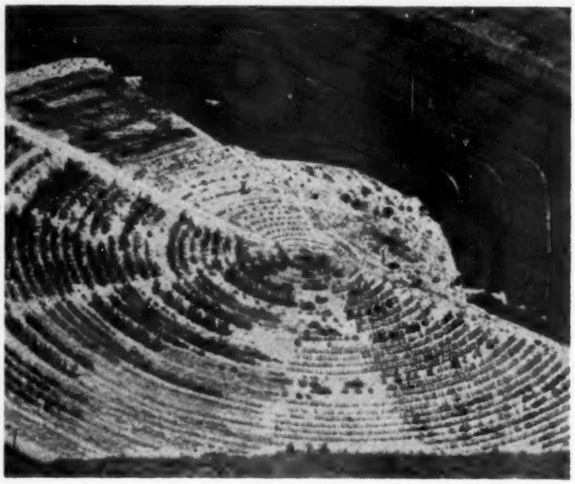
When the cobalt is raised above ground level, gamma rays from the cobalt penetrate the steel pipe and shoot out in all directions over the field striking plants growing near or above the surface of the ground. When the cobalt is lowered into its lead chamber in the ground, plants growing in the field are completely shielded from the cobalt's atomic radiations.



APPARATUS FOR CONTROLLING GAMMA EMITTER

USED IN FIELD IRRADIATION OF PLANTS (SCHEMATIC)

The field is cultivated in concentric circles or arcs. This is pictured below. Plants can then be grown at equal or varying distances from the source of atomic radiation. Moreover, by raising or lowering the cobalt, plants growing in the field can be irradiated at controlled intervals; also, the field can be rendered safe for the experimenter to approach the plants for examination or handling.



Brookhaven National Laboratory

Field planted in concentric circles or arcs for experimentation on effects of radiation.

How do gamma rays affect the growth of plants? Can gamma rays—say, the gamma rays from radioactive cobalt-60—induce mutations in plants? To answer these questions, a variety of plants were rooted in the circular "rows" of the field described above. Among the plants used were the broad bean (*Vicia faba*), the common potato (*Solanum sp.*), tradescantia (*T. paludosa*), and corn (*Zea mays*). The plants were arranged at measured distances from the source of radiation, the distances having been calculated so as to provide graded dosages of gamma radiation. Since gamma rays penetrate plant tissues sufficiently, there was no problem of one plant "shadowing" another.

Space will permit a description of results obtained with tradescantia only. Well-established plants were transplanted into their desired locations and then cut back to about two inches above ground level and subjected to radiations from the Co^{60} source. The effects of about four months' exposure are illustrated in the picture at the top of the following page.

Notice that intensive radiation (128, 82, and 67 roentgen per day) results in almost complete ab-

Brookhaven National Laboratory

128 r./day | 82 r./day | 67 r./day | 50 r./day | 30 r./day | 22 r./day | 15 r./day | 0 r./day control

sence of growth.* Thirty roentgen per day still inhibits growth and induces leaf fasciation and peculiar, sterile inflorescences with an excess of anthocyanin. At 22 r. per day growth is almost normal, but the plants are highly sterile, while at 15 r. per day the plants look normal but show cellular damage when examined under the microscope (see text and the illustrations below). The plant that was farthest from the source looked almost normal—like the control plant.

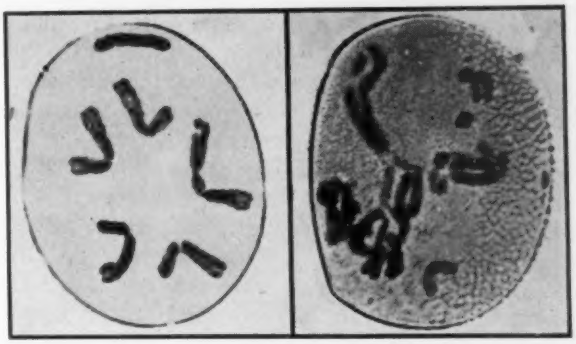
An interesting observation in these field experiments is that the growth of other cultivated plants such as corn, tomatoes, and potatoes and of certain common weeds, like pigweed and ragweed, was not appreciably affected. This illustrates the fact that different species of organisms vary widely in their inherent resistance to radiation damage.

In 1927 H. J. Muller discovered that fruit flies irradiated with X rays yielded mutant offspring. In other words, the X rays affected the cytogenetic composition of the animals. Growing tradescantia plants were found to be similarly affected when irradiated in the field with gamma rays.

The photographs on the right show the normal set of chromosomes of *Tradescantia paludosa,* in comparison with the chromosomes in a cell from a plant of the same species which had been subjected to gamma radiation. Notice the very long chromosomes (translocations) and the fragmentation. Each of these induced chromosomal changes is a potential morphological or physiological mutation. Other mutations not associated with breaks may also result from the radiation. Atomic radiation thus accords a method of multiplying variants (mutants) from which plants with desirable characteristics can be bred by hybridization and selection.

By means of X-ray irradiation, strains of Penicillium have been produced that yield a tenfold increase of penicillin over strains known to occur in nature. In Sweden the barley crop was improved by utilizing X-ray induced varieties for breeding purposes.

Dr. Singleton, at the Brookhaven National Laboratory, subjected growing corn to gamma radiations from the cobalt-60 source and obtained several interesting mutations.



Left: Normal set of chromosomes of TRADESCANTIA PALUDOSA. Right: Chromosomes following subjection to gamma radiation.

The induction of mutations by penetrating radiations opens a new door in research, a door which may lead not only to new achievements in practical genetics but possibly also to new explanations of life phenomena revealed through the use of invisible atomic radiations.

The author is indebted to Dr. Karl D. Hartzell and to Dr. A. H. Sparrow for their courtesy in showing the author through the laboratories, explaining most of the experiments, and furnishing the photographs used in this paper.

* The roentgen is defined as the quantity of X rays or gamma rays which will produce, as a consequence of ionization, one electrostatic unit of electricity, of either sign, in 1 cc. of dry air as measured at 0 degrees C. and standard atmospheric pressure.

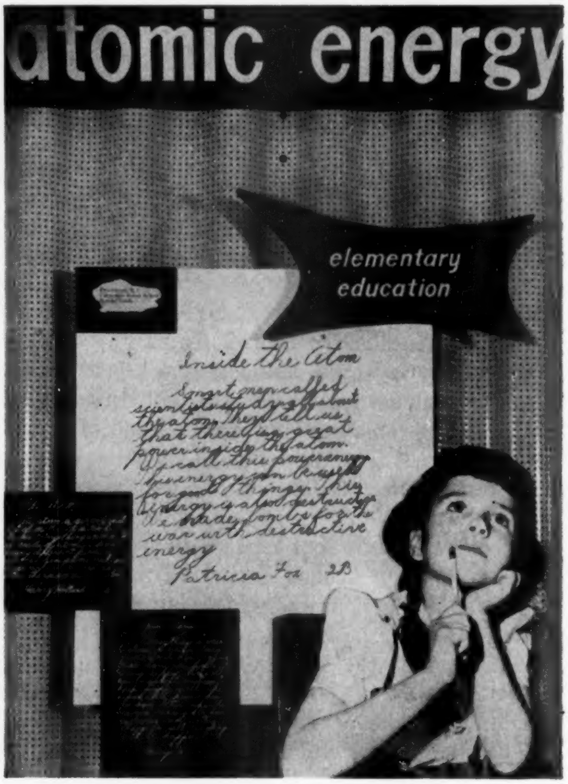
Leads on Atomic Energy Source Materials for Teachers

IF YOU'RE GOING TO TEACH about atomic energy (and what science teacher isn't?), here are a few suggestions that may lead directly to source materials essential to your purposes. Limited space precludes any attempt at a complete listing in these pages. Therefore we have tried to sample and indicate the kinds of helps available to teachers that may be obtained from various sources. *Editor.*

1. Associated Universities, Inc., operator of the Brookhaven National Laboratory, provides a number of educational services in addition to the loan of its traveling library pictured on the cover of this issue of *The Science Teacher*. These include advice and assistance in the planning of conferences and the securing of speakers; a variety of bibliographies and film lists; and the loan of films and filmstrips, as well as sample quantities of free materials and materials for sale on consignment. The audio-visual aids list is annotated. The "Selected List of Articles, Reprints, and Pamphlets on Atomic Energy" runs 17 mimeographed pages. The seven-page list of books (and their prices) included in the "five-foot book shelf" provides guidance in ordering for the school or science department library and suggests that other organizations might compile similar traveling libraries at a cost of about $350. Included in this collection are several titles suitable for use at the elementary school level.

Inquiries about the above items should be addressed to Dr. Karl D. Hartzell, Educational Services, Associated Universities, Inc., Upton, Long Island, New York.

2. Advice and assistance are available to schools from the Washington and area offices of the Atomic Energy Commission. The addresses of the latter are as follows:



The development of ideas and understandings about atoms requires time. Perhaps the second grade is not too early to start. Such ideas can be used to explain many of the things children do and see happen in the science corner or laboratory.

New York Operations Office
P. O. Box 30, Ansonia Station
New York, New York

Chicago Operations Office
P. O. Box 6140 A
Chicago 80, Illinois

Idaho Operations Office
P. O. Box 1211
Idaho Falls, Idaho

Santa Fe Operations Office
Los Alamos, New Mexico

Savannah River Operations Office
Augusta, Georgia

Schenectady Operations Office
P. O. Box 1069
Schenectady, New York

Hanford Operations Office
P. O. Box 550
Richland, Washington

Oak Ridge Operations Office
P. O. Box E
Oak Ridge, Tennessee

Requests to the Washington Office should be addressed to George Glasheen, deputy director for educational services, Division of Public Information Services, U. S. Atomic Energy Commission, Washington 25, D. C.

3. Conferences on atomic energy education for secondary school teachers scheduled this fall in the northeastern area include the following:

October 15, Slippery Rock State Teachers College, Pennsylvania

October 18, Evening session of the New Hampshire State Teachers Association annual meeting, Concord

October 26, New York State Teachers Association, Long Island Zone, afternoon session, Hempstead

October 30-31, Conference for secondary school teachers and administrators in the Philadelphia area, sponsored by Eastern Pennsylvania Council of School Administrators, University of Pennsylvania, Franklin Institute, and West Chester State Teachers College, Museum Auditorium, University of Pennsylvania

A two-day workshop on atomic energy is scheduled for fall (dates undecided at this writing) in Pocatello, Idaho, at the State Teachers College.

4. Four bibliographies prepared by the Interdivisional Committee on the Educational Implications of Atomic Energy, U. S. Office of Education, are as follows:

No. 1. *Bibliography of Bibliographies on Atomic Energy* (For Teachers, Students, and Adult Discussion Groups), February, 1949.

No. 2. *Introductory Bibliography on Atomic Energy* (For Teachers, Students, and Adult Discussion Groups), March, 1949.

No. 3. *Teaching Aids in Atomic Energy: Bibliography for Teachers,* March, 1949.

No. 4. *Inexpensive Books and Pamphlets on Atomic Energy,* May, 1949.

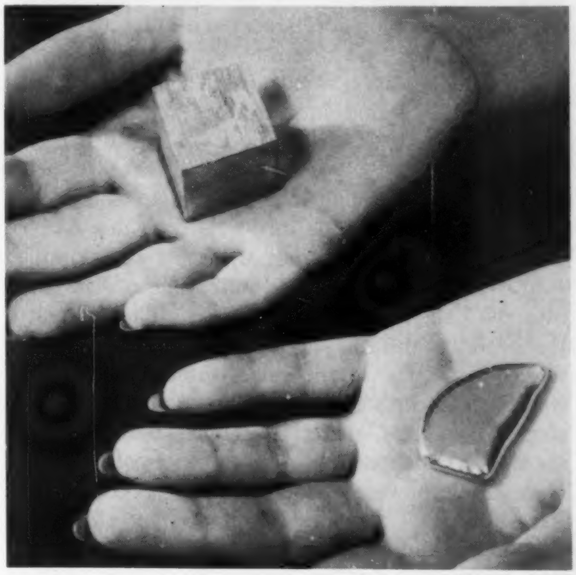
The March, 1949, issue of *School Life* and its supplement, titled "Atomic Energy Here To Stay," are still useful teaching materials. On these and the four bibliographies, write to Dr. Philip G. Johnson, specialist for science, Secondary Division, U. S. Office of Education, Washington 25, D. C.

5. Write to the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for a copy of the pamphlet, "The Use of Atomic Energy, the Business of Every Citizen," which lists selected government publications on this vital subject.

6. Elementary school teachers who wish to include appropriate aspects of atomic energy in their science or social studies work can do no better, so far as we know, than refer to Blough and Huggett's *Methods and Activities in Elementary School Science,* Dryden Press, 1951. "Atomic Energy and Its Uses," Chapter 19, deals specifically with the teaching of atomic energy at elementary school levels. Mr. Blough is specialist for science, Elementary Division, U. S. Office of Education. He is widely known as co-author of the Scott, Foresman elementary science textbooks. Mr. Huggett is assistant professor of education at Michigan State College.

7. The outlook for careers in fields of atomic energy is currently a big question in the minds of many secondary and college students in science. Extremely helpful here is Karl D. Hartzell's *Opportunities in Atomic Energy,* published by Vocational Guidance Manuals, 45 West 45th Street, New York City 19 (price $1.00). Reviewed on p. 218.

What Is It?



Musgrave Photo

It's gallium—about $5000 worth of the rare, silvery-white metallic element. Gallium melts at 86°F.; does not boil until heated to approximately 3700°F.; retains bright, shiny luster at temperatures as high as 1000°F. Similar to aluminum in chemical behavior, gallium is not a "light" metal (sp. g. 5.9). The liquid wets many nonmetallic surfaces; like water, but unlike most elements, expands on solidifying. Forms orthorhombic crystals. Found as traces in many ores and minerals, Alcoa is now extracting gallium from bauxite—which contains about one ounce per ton. Research as to uses for gallium is under way.

A Science LABORATORY *for the* ELEMENTARY SCHOOL

By ALBERT PILTZ

Experience curricula are now widely accepted as fundamental in our modern elementary schools, and educators have been striving to provide purposeful experiences for children in every area of study. No field of work offers as great an opportunity for enriching children's experiences as science. The laboratory is an integral part of science instruction on the secondary and college level. Why not provide elementary school children with laboratory experiences in science on levels commensurate with their needs, abilities, and interests?

How this question was translated into action over a seven-year period in the Roosevelt Elementary School, Detroit, is the subject of this discussion.

The need for a workshop or laboratory arose when a child demanded individual attention and expressed a strong urge to develop an idea derived from a class demonstration. Materials were supplied—and the child was sent outside the classroom, into the hall, to carry on the work. The success of the activity and the need for similar experiences subsequently led to the establishment of a corner workshop in the science room. A small table, a vise, some basic tools, materials, and a bulletin board above the table formed the work center of the room. Here children were encouraged to "try out" projects of interest, or were motivated by the visual aids on the bulletin board to experiment. The bulletin board, titled "Our Science Workshop," helped focus attention to the workshop.

However, the corner workshop had its limitations. Often, in the construction phase of activity, a hammer would disturb the rest of the class. Many children were denied participation due to lack of space. The workshop in its early stages was also limited as to variety of activities. Space for housing equipment and supplies made it even more of a problem. As interest in working in the "science corner" became greater, the need for expansion became acute.

Happily, after two years of preliminary work, a classroom across the hall became available, and the transition from "corner workshop" to "room workshop" and laboratory became a reality.

A group of tables and desks, surplus to school needs, were arranged for children's use. Small tables were placed end to end along two walls of the room. These tables became the museum portion of the laboratory and were divided into both biological and physical science areas. These, in turn, were subdivided into sections on plants and animals; marine life; rocks, minerals, and fossils. A child curator or director for each section with a group of assistants prepared, arranged, classified, and labeled the specimens brought in by children and teachers. When displays became overcrowded, lengths of boards furnished tiers upon which additional materials were placed. Space under the tables provided for storage of specimens, models, and other instructional aids. The tables were skirted with paper on which descriptive legends were printed to help explain exhibits on the tables.

Larger tables and desks arranged around the room provided working space with easy access for children. The tops of the tables were covered with fiber

This article reviews convincingly some of the reasons for including laboratory work in science instruction at the elementary (or any other) level and goes on to give what we think are practical suggestions for implementing the idea. It's all based on experience, too. All of which is why we believe our readers will find the article well worth reading.

Mr. Piltz—is supervising teacher, Roosevelt Elementary School, Detroit; has taught elementary science in Detroit elementary schools for ten years; has conducted audio-visual workshops and given special science lectures at Wayne University and the University of Detroit; is elementary science editor, *Metropolitan Detroit Science Review;* is chairman, elementary science section, Central Association of Science and Mathematics Teachers; is presently science consultant for workshops, College of Education, University of Florida.

materials. It was here that construction, experimentation, and project building was carried on.

In one corner of the room were a tool crib and a work bench. The tools were provided by an interested and cooperative parent and were arranged in full view of the room. Children learned to use tools and to replace them properly afterward.

A large closet became the photographic "dark room." Interested parents supplied much of the photographic equipment; a local hobby shop provided the printer and enlarger. An extension cord furnished the current needed for operation.

An old storage case with sliding doors served as a fluorescent dark room in which rocks containing fluorescent minerals glowed under "black light." A section of the case was cut away to allow for greater accessibility. The children could view the specimens first under white light and then black or ultra-violet light and identify the minerals from color charts. Other materials, such as oil, mercurochrome, plastics, and the brightly colored clothing children wore, were "tested" in the black light chamber.

Mural Depicts Evolution

Groups of children worked for months in designing and painting a huge mural which extended along the entire length of the room. It portrayed the evolution of the earth and its inhabitants.

The blackboard portion of the room was directly adjacent to the Marine Life section of the museum, and highly colorful chalk drawings of marine life in action served as a backdrop for the many species of sea life on exhibition. Again, the drawings were the children's work.

There were bulletin boards, charts, dioramas, mock-ups, exhibits, and numerous three-dimensionals placed strategically around the room.

At the entrance to the laboratory was a work sheet which every child was required to complete before leaving the room. The following information was recorded and served as a basis for further study: date; name of child; time in and out; work accomplished.

Children who demonstrated proficiency and who learned to accept responsibility were designated as foremen, and one of them would take charge of the laboratory when the teacher was not present. In some schools it would be required that a teacher be present at all times. Teachers may then arrange time schedules.

The laboratory is a tremendous force in the learning process. However, it requires careful organization, a cooperative faculty, and a sympathetic administrator. The laboratory, by its fundamental structuring, encourages individualized teaching as opposed to mass instruction. Many teachers will use the laboratory as an incentive for children; some will extend its use as a privilege granted for work well done. Some teachers may resent its use because it opposes passive study.

Skills of all Fields Utilized

But the fact is that in the laboratory children deal with *real* situations and have immeasurable opportunity for utilizing skills obtained in all subject matter areas. A child constructing a model airplane, measuring the wing span, or computing fuselage dimensions applies arithmetical concepts in his work. He is provided with library experience when he classifies a specimen collection. Attempting an experiment from his reading brings into full play his language arts. If special situations arise, laboratory experiences may be modified to fit them.

Elementary school educators are giving increased attention to the mental and emotional health of children. Here, too, the science laboratory can prove its worth. Some children may overcome difficulties in group adjustment. Exceptional children at either extreme of the spectrum can find outlets for their interests in a medium where each individual can work on his own level of maturation. Isolates and rejectees who may have no friends can find a place in the laboratory, and when skills are attained, recognition for achievement follows and friends become easier to make. This gives them a feeling of success and belonging. The variety of science interests among the children contributes greatly to originality and creativeness. The work phase provides for growth in self-direction, resourcefulness, and ingenuity.

Laboratory Becomes "Science Fair"

In many fund-raising projects through the years, in which the home and school staged a festival, the science laboratory became the "science fair." With their teachers' guidance, children planned and set up experiments and demonstrations. Charts, graphs, pictorial material, displays, and exhibits were but a few of the many media children used in communicating their ideas to others. Children who were members of the science club acted as guides for exhibits; another group of children demonstrated in many areas of science. Hundreds of children, parents, and visitors came to enjoy the science show.

Children returning from vacation trips, camps, and lake resorts bring with them many objects and specimens which find a cherished place in the museum section of the laboratory. Photographs taken of places visited may be developed, printed,

and enlarged in the "dark room" of the laboratory, and may eventually be used for display purposes.

By the varied and intelligent use of science materials in the laboratory, the child develops skills in problem solving, planning, giving demonstrations, generalizing, and selecting and utilizing materials to meet his everyday needs. The spotlight is on "doing." Manipulative skills in construction and techniques in preserving and mounting specimens are all part of the learning process.

When the emphasis is on "doing," including laboratory activity, science becomes part of living; each child may reach his own level of maturity and find appropriate materials on his own levels of learning. It allows outlets for the child's imagination, broadens his interest in the world in which he lives, gives him status as an individual, and develops good work habits of thinking, acting, and doing.

Attention of elementary teachers interested in a science activity program is called to the NSTA series of booklets describing experiences for upper elementary and junior high grades. For titles and prices see page 200.

The Health Science Club

By JOHN E. HABAT

Instructor in Science, Shore School
Euclid, Ohio

Too often the label "Inferiority Complex" is placed on boys and girls merely because those human differences with which we are all possessed become more evident with increased years. The youngster whose height, weight, or strength is less than that of his schoolmates has a natural tendency to dislike participation in athletics with those of greater physical prowess. Such a tendency cannot always be rightly called an inferiority complex. To help improve these differences is the purpose of the Health Science Club at Shore School, Euclid, Ohio.

Here, in quarters well equipped for the purpose, these youngsters learn to help each other, and themselves. In "teams" of four, boys with similar dispositions and common problems work together. With systematic training and encouragement bodies are built up, carriage is improved, muscles are developed, and a wholly new outlook is born.

The distinctive feature of the Health Science Club lies in the fact that this process of development does not stop with physical exercise and a shower. Far from it! Rest and a massage play an important part. Each boy is taught the correct way to massage tired muscles, to produce that welcome feeling of complete well-being. A chart illustrates the anatomy of the body, and his health book instructs him in physiology.

A brisk rub-down with invigorating skin stimulants and antiseptics almost, but not quite, completes the health session. Believing that good grooming has an important place in the physical fitness picture, that phase is not overlooked. After a 45-minute experience in the Health Science Club these boys can take one look in the mirror and be rewarded with a smile and a new feeling of confidence which is their common goal.

The health lessons which are learned during the six weeks course, the desire for physical fitness, and the knowledge of how to acquire and retain it, carry these youngsters on through school and into adult life with a sureness and a new confidence.

So popular is this unique club that upwards of 100 boys each year enjoy active participation, some of them arriving as early as 7:30 in the morning to "get set" for the day.

A study of the effects of this health-building program reveals that many of these once timid youngsters become leaders in other scholastic activities. An improved attitude toward school generally results in improved classroom work. Enthusiastic parents frequently report that a better morale is evident in the home.

Surely we, as teachers, have an obligation to guide as best we can each student, boy or girl, toward the goal of a healthier and a happier personality. This, as cited by the Mid-Century White House Conference, is youth's right as an American citizen.

For the Ladies— KITCHEN PHYSICS

By JAMES B. DAVIS

Teacher of Physics, Lower Merion Senior High School
Ardmore, Pennsylvania

Have you heard the wail from the feminine members of your physics classes, "Gee! I'll never get this. And what good would it be to me, anyway? It's a boy's subject; boys are more mechanically inclined than girls." You can usually stop the moaning by asking one rather pointed question, "Do you think boys are smarter than girls?" Also, you can mention that at graduation the girls usually walk off with two-thirds of the scholastic honors and prizes. Three times out of four the class valedictorian is a girl. Surely there are some erroneous ideas about girls studying physics. If they have the intellectual ability there is no good reason why girls should not have just as much success in studying physics as boys have.

Many of the young ladies in question will spend considerable time in the kitchen as they grow older, and either marry or assume certain household duties. The very fact that they studied physics in high school should enable them to move around the kitchen with a certain "know-how" that one would not find in a woman who had not studied physics.

Let's consider some Kitchen Physics:

CALORIES—The meaning of the energy value expressed in large calories is better understood by one with a knowledge of high school physics.

VACUUM BOTTLE—With the three methods of heat transmission ideally illustrated, most housewives are not too much concerned about why liquids stay hot or cold in vacuum bottles and jugs. On the other hand, however, most women are curious.

MECHANICAL REFRIGERATORS—Many women think that there is some mysterious behavior of electric current that accounts for the refrigeration. High school physics has told the others that the refrigeration is due to the cooling effect produced by the evaporation of a liquid.

TEA KETTLES—A roughened, dark-bottomed tea kettle may not be the pride and joy of an efficient housewife, but it is a better absorber of heat than a bright and shiny one.

COFFEE—Coffee can be kept hot without boiling by placing the coffee pot in a container of boiling water. Those who resort to putting the coffee pot over a direct flame are not complimented for their good coffee. This is just another illustration of heat transmission.

EGGS—There are times when the lady of the kitchen will inadvertently mix some hard-boiled eggs with her fresh eggs. Having been informed in her physics class, she will know that by spinning them she will be able to separate them. A hard-boiled egg will spin very readily being one mass, while a fresh egg being of two different liquid masses will hardly spin at all. This is a unique illustration of inertia.

COOLING—The uninitiated would not know that a saucer of ice placed on top of a pitcher of liquid will cool it in a surprisingly fast time. In convection currents hot air rises, cold air will fall. The old fashioned ice box had the ice placed in the top of the cabinet.

THERMOSTATS—Modern cooking ranges, gas or electric, are thermostatically controlled (bimetallic strip); thus a culinary masterpiece is always a hit and never a miss.

One could go on and on and mention many other devices and behaviors that function in the kitchen and readily illustrate some physical principle once learned (more or less) in high school physics. Then one could move to the living room and begin all over again with radio, television, indirect lighting, fluorescent lamps, mirrors, air conditioning, and home movies—repeat the story in every room in the home, from the basement to the attic.

All of this merely points out that one may live more graciously and understandingly with a small amount of knowledge acquired in a high school physics course, even if one happens to be of the feminine sex.

Teaching Kits *for* Science

Teachers examine the contents of the Teaching Kit on Atomic Energy

By HUBERT J. DAVIS

The idea of assembling many kinds of materials on a single topic to be used as a unit is not new. However, to enlist the cooperation of teachers, pupils, supervisors, and principals of a large school system in preparing such material is new.

Such packages of materials in Norfolk County are called "Teaching Kits." This is an account of an idea that grew and resulted in the preparation of many kits by the Norfolk County Teaching Center in cooperation with the schools.

The need for high school science kits grew out of the numerous demands by teachers for supplementary materials. The Teaching Materials Center, working with the science teachers and their librarians, assembled pictorial and descriptive materials from many sources on specific science topics. But this did not adequately meet the needs.

Hubert Davis in one of the most practical, down-to-earth science supervisors we know, which is why we're confident his discussion of kits for science will be helpful to many teachers. Cooperative endeavor is the accepted practice among the science teachers in Mr. Davis' county system, both vertically from the elementary grades through high school and cutting across the "special" science fields. Making much out of little and seeking to make it functional provide commonness of purpose.

Mr. Davis is an evaluator for the NSTA packet service and has participated in several evaluation and consultation conferences on sponsored teaching aids for science. He is NSTA state director for Virginia.

Biology teachers began a search for materials on local resources. Their requests for material of a textual nature was met with a kit of bulletins and books on marine life. A group of teachers worked with the supervisor in developing a bulletin on suggestions for setting up an aquarium and collecting and preserving specimens. Pupils and teachers worked together to prepare a kit of preserved specimens. This kit now contains more than 200 local specimens, preserved and packed for immediate shipment to the schools.

Later, when the interest shifted to reptiles, similar requests were received and met with a textual kit. This again was supplemented by the development of a booklet on the more common reptiles found in our county and a complete kit of preserved specimens for classroom use.

The latest development has been the preparation of exhibit displays for use in the schools. These consist of a well-planned display of specimens in a case which has a background picture to add interest and information to the exhibit. Both the exhibits and the art work are done by high school pupils under the guidance of the art and science teachers.

The high school kits were so popular with teachers that, when a similar need for supplementary materials arose in connection with the eighth-grade science program, the kit idea was used. This need was somewhat different. It involved providing actual text materials which normally would be obtained by the pupils. Since the eighth-grade pupils paid a fee in lieu of purchasing textbooks, it was a simple matter to collect a part of the textbook fee from each pupil and use it to finance the preparation of

teaching kits. This made it possible to include many inexpensive science bulletins on different reading levels. It was also possible to provide a wealth of supplementary materials which would not normally be found in the local libraries.

In planning for these kits, each science teacher suggested a number of topics. Six were finally selected, and kits were assembled. Cooperative planning with the science teachers and the librarians resulted in the discovery of a great variety of materials on each topic.

The local tuberculosis association cooperates with the Teaching Materials Center each year in planning kits of materials on tuberculosis. The association supplies such materials as X-ray films, bangles, schedules for the mobile X-ray machine, great quantities of literature, filmstrips, and films. These materials, along with a teacher-prepared source unit, are assembled in kits and loaned to the teachers. Each year more than 100 kits are assembled and used.

Complete Kits Packed for Distribution

The kits are packed permanently in boxes. A packing list gives the number and title of each item included. There is a complete list of audio-visual and other supplementary teaching materials which may be used with the kit. Each kit of textual material contains enough material to supply an average-size class. There are from 15 to 30 pamphlets on significant topics. Less important and more technical topics are covered with five or more pamphlets. Special books, identification keys, magazines, and hard-to-get materials are included. Most kits contain teacher handbooks, manuals, and other teaching suggestions. Some have broad outlines or source units.

Many of the regular kits are supplemented by special kits. For example, the marine life kit is supplemented by a kit of marine specimens, a kit of materials on shells, a kit of Virginia shells for identification purposes, a kit of fossil shells, etc. The kits on nutrition are supplemented by models, living animals, and instructions and materials for conducting nutrition experiments with live animals. All kits are supplemented by a good film, filmstrip, recording, and tape recording library.

While the kits were originally planned for use in high school, they are widely used by the upper elementary grades. They are flexible and serve many purposes. Such kits as those on atomic energy and sex education are often used by teacher and adult study groups.

When the kits are used in the elementary school they can be supplemented by kits of laboratory equipment and apparatus from the Teaching Materials Center.

This is the third year the kits have been in use. Each year the use of these kits increases. This year they have been used more than five times as often as they were during the first year. The center continues to receive requests for many types of kits to cover other subject matter fields.

Kits Start Where Textbooks End

Two needs these kits serve stand out above all others. First, there is a very definite need for something to begin with where the textbook ends. It takes years to plan and write a textbook. Once it is adopted for use in a state where the state-adopted plan exists, it is likely to be used for several years. Before it can be put in use, it is very much out of date. It is impossible for a science textbook to catch up with scientific research. The teaching kit helps to bridge this wide gap. Secondly, there is an abundance of free and business-industry sponsored materials available from many sources. Busy teachers find it very difficult to discover these materials and impossible to have them at hand in quantities at such time that they are most helpful. By cooperative planning with the science teachers, librarians, and pupils, the Teaching Materials Center is able to help solve this problem for the teachers.

When audio-visual materials are considered to be of more value in the development of a topic around which a kit has been planned than of general value to the whole county, the materials are kept permanently with the kit. This is often true of such items as atomic models, planetaria, filmstrips, slide units, and occasionally a film.

Booking Handled at Center

The kits are loaned to teachers from the Teaching Materials Center for a period of from three to six weeks. They are booked as a unit just as a filmstrip or a film is booked.

Each month the science teachers meet and plan their work. They are able to plan the use of kits so that no two schools will work on the same topic at the same time. Therefore, a small number of kits will supply a large number of class groups. In most cases there are five kits on a topic. Each kit on a single topic is exactly like each other kit on the same topic.

Kits have been planned around 38 science topics. They cover astronomy, atomic energy, conservation, diseases, electricity, healthy living, insects, lumber, marine life, fossil shells, sex education, Virginia shells, minerals, steel, oil, soil, care of the eyes, coal, nutrition, and many others.

PAPER CHROMATOGRAPHY

By FRANCES WHITE

PAPER chromatography is a method of analysis, which has become popular in the last few years, for the separation and identification of some exceedingly complex materials. The word chromatography is derived from the Greek "chroma," meaning color, and "graph," meaning write. Paper chromatography implies that the compounds identify themselves on the paper by colored spots or bands. The separation of one substance from another depends on the rate of diffusion of the liquid in the paper or on the degree of adsorption of the substance by the paper. It is well known, for example, that water spreads over paper faster than alcohol and that ions such as potassium and phosphate are adsorbed more strongly than those of sodium or chloride. After the materials have been separated on the paper, they may be identified directly if they are colored; or if they are colorless, characteristic reagents may be added to produce a colored compound. For example, the constituents of a colored ink may be observed directly, but an ion such as aluminum is treated with the reagent aluminon to produce a red compound.

The purpose of this article is not to give an extensive treatise on paper chromatography but simply to describe the procedure which was used in preparing an exhibit for a high school science fair. The importance of this method of analysis is indicated by the fact that in the period from 1948 to 1949 over 200 papers appeared in scientific journals on this subject. A few references are given at the end of this article for the benefit of those who wish further information.

The following is a list of materials that are needed to carry on the procedure described:

Black ink—Sheaffer's Skrip Washable Black
Brown ink—Sanford's Penit
Yellow dye—mentanil yellow (or any water soluble yellow dye) 0.1% water solution
Green dye—malachite green (or any water soluble green dye) 0.1% water solution
Mercurochrome—2%—5 ml. of water solution
Nickel chloride—5%—10 ml. of water solution
Ferric nitrate—5%—10 ml. of water solution
Aluminum nitrate—5%—10 ml. of water solution
Lead nitrate—5%—10 ml. of water solution
Bismuth chloride—5%—10 ml. of solution in 5 ml. of conc. hydrochloric acid plus 5 ml. of water
Antimony trichloride—5%—10 ml. of solution in 5 ml. conc. hydrochloric acid plus 5 ml. of water
Cupric sulfate—5%—10 ml. of water solution
Dimethylglyoxime—0.1 g. in 10 ml. 95% ethyl alcohol
Potassium ferrocyanide—10%—10 ml. of water solution
Aluminon 0.1%—10 ml. of water solution
Potassium iodide—10%—10 ml. of water solution
Hydrogen sulfide, aitchtuess—1 oz.
Hydrochloric acid—about 10%—50 ml.
Acetic acid—about 10%—50 ml.
Filter paper qualitative quality as Whatman Number 1—200 sheets—5 cm.
Filter paper—100 sheets—11 cm.
Filter paper—30 strips of 10 by 1 in.
Filter paper—15 strips of 6 by 3 in.
Medicine droppers—6

Experimental Procedure

Black ink demonstrates vividly the various methods that can be used to separate materials. In the

Here is an article that project-hungry students in chemistry will find to their liking. It's a description of "how one student did it" and was written by the do'er. Frances' project on paper chromatography was good enough to take her through the D. C. Science Fair and into the 1950 National Science Fair where she won a first award.

Frances is now a sophomore at the University of Maryland, where her father is professor of chemistry. Interestingly, one of her high school teachers and sponsors was Mr. Howard Owens who, with co-authors Milford H. Dinker, Jr. and George C. Doepp, also makes *The Science Teacher* this month with the article on page 199.

descriptions below a drop refers to the drop as obtained from a medicine dropper.

Solvent moves up. (Figure 1) A drop of ink is placed three-quarters of an inch from the bottom of a ten-by-one-inch strip of filter paper (Figure 1). The strip is suspended in a milk bottle so that the lower one-half inch below the ink spot touches the water in the bottom of the bottle. A cork is placed in the bottle to hold the paper and to prevent evaporation. After about 15 minutes the various constituents of the ink will appear on the paper separated in distinct layers. The paper is then removed from the bottle and suspended with a clothespin to dry.

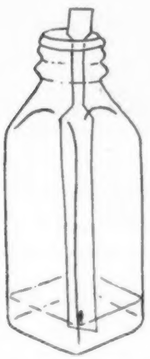


Fig. 1
Solvent Moves Up

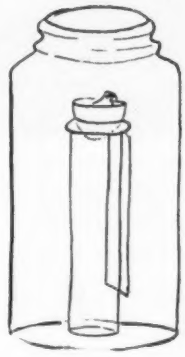


Fig. 2
Solvent Moves Down

Solvent moves down. (Figure 2) Place a small olive bottle in a wide-topped quart jar. On top of the bottle put a crucible half filled with water. Put a drop of ink an inch from the top of a six-by-one-inch strip of filter paper and put the top end of the paper in the water in the crucible. A stone on the paper will hold it in place, and a cover on the jar will stop evaporation. After the constituents have separated down the paper, remove the strip and let it dry.

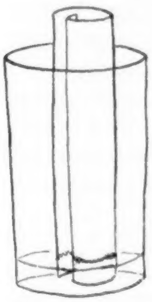


Fig. 3
Cylindrical Paper

Cylindrical paper. (Figure 3) Roll a piece of filter paper six inches long and three inches wide into a cylinder and fasten by cutting tabs in the paper. Place a line of ink one-quarter inch wide completely around the cylinder three-quarters of an inch from the base. Set the paper cylinder in one-half inch of water until the colors separate.

Center cotton wick. (Figure 4) Place a small wad of raw cotton through a hole in the center of a piece of 11-centimeter filter paper. Put ink on

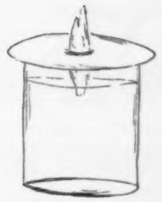


Fig. 4
Center Cotton Wick

Fig. 5
Pack

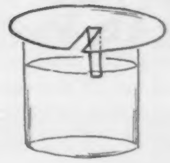


Fig. 6
Disc

the paper around the wick. The tip of the cotton is then put in water by placing the paper on a tumbler nearly full of water. When the rings of color separate on the disc, remove the wick from the water.

Pack. (Figure 5) Using 200 sheets of 5-centimeter filter paper, place five drops of ink on the 20th piece of paper from the bottom. Put the pack in water up to the tenth sheet and place a pound weight on top of the pack. In about 12 hours the ink will reach the top and the pack may be separated into sections of different colored constituents of the ink.

Disc. (Figure 6) Using 11-centimeter paper, cut a strip one-quarter inch wide nearly to the center of the disc. Place a drop of ink on the middle of the strip. Place the disc on a glass and let the tab touch the water, as shown in the diagram. Remove when constituents are separated.

Creased paper. (Figure 7) A rectangular piece of six-by-one-inch filter paper is creased lengthwise, and a few drops of ink are placed on the crease three-quarters of an inch from one end. The paper is placed in a test tube that has one-half inch of water in the bottom. Remove when the constituents are separated.

Fig. 7
Creased Paper

Any of the preceding methods may be used in the separation of ions and compounds, but some are found to be better than others. For the separation of various inks and mercurochrome, the disc is good. In using the yellow and green dye, a drop of each is placed together on the wick of the disc, as explained with the ink. These are some examples to try; other dyes and inks make interesting experiments.

The ten-inch strips with the solvent moving up are good for separating compounds and ions. The same procedure is used as with the ink. A drop of solution containing a mixture of ions is placed near the bottom of the paper, and the end of the paper

is suspended in a solvent. When the solvent has been absorbed most of the way up the strip, the paper is removed and reagents are then applied to the paper with a medicine dropper. To show separations of the metallic ions, the following combinations are good: nickel and iron; aluminum and lead; bismuth and antimony; iron and aluminum; copper and aluminum; iron and lead; nickel and lead.

Reagents used for development are: aluminon for aluminum; potassium iodide for lead; potassium ferrocyanide for iron and copper; dimethylglyoxime for nickel; hydrogen sulfide gas for bismuth and antimony. The proper selection of a solvent is important. One must be chosen which will not react with the ions to be separated, and cause precipitation. In the combinations above ten per cent acetic acid should be used when the material contains lead, and ten per cent hydrochloric acid with the bismuth and antimony mixture. Water may be used in all of the other cases. When the reagent is applied, various colors will be brought out. Nickel is red, iron is blue, and lead is yellow.

The adsorption quality of various papers is different. For example, drops of nickel and lead on typing and mimeograph paper did not move in five hours, but on filter paper Whatman number 41 a good result was obtained in one hour; filter paper Whatman number 1 also produced excellent results.

For exhibition purposes strips were dried and mounted on heavy white poster paper.

Science Service Photo

Frances White at the 1950 National Science Fair where her work on paper chromatography merited a first award.

References

Clegg, D. L. *Analytical Chemistry.* Vol. 22, Page 48. 1950.

Gage, T. B., Douglas, C. D., and Wender, S. H. *Journal of Chemical Education.* Vol. 27, Page 159. 1950.

Goetz-Luthy, Nydia. *Journal of Chemical Education.* Vol. 26, Page 271. 1949.

Stein, William H., and Moore, Stanford. *Scientific American.* Vol. 184, Page 35. 1951.

Strain, H. H. *Analytical Chemistry.* Vol. 21, Page 75. 1949.

Atomic & Molecular Models

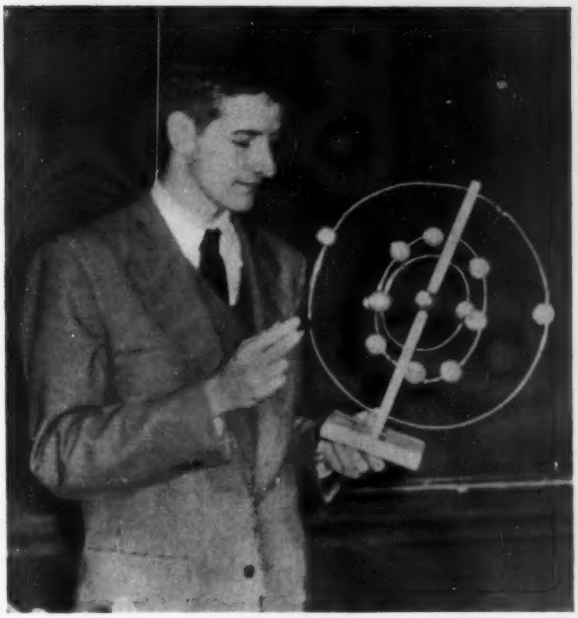
By

GEORGE C. DOEPP
Instructor of Biology
Hyattsville, Maryland, High School

MILFORD H. DINKER, JR.
Instructor of Biology
Hyattsville, Maryland, High School

and

HOWARD B. OWENS
Chairman, Science Department
Hyattsville, Maryland, High School



In keeping with the dynamics of our times, a modern biology textbook used by the authors in teaching high school biology has included a chapter on chemistry and one on physics. An elementary knowledge of these physical sciences certainly contributes to a better understanding of many biological phenomena. However, in attempting to teach this newly included material, the usual supply of audio-visual aids was lacking. To remedy this situation, the authors devised a few pieces of equipment which they believe to be both economical and effective.

Atomic structure model. In order to show the structure of an atom, a model was constructed from the following materials.

> About six feet of wire similar in thickness to that generally used in coat hangers; one piece of one-half-inch dowelling, 18 inches long; one piece of scrap wood, approximately six inches by six inches by one inch; one dozen plastic balls, one-and-one-quarter inches in diameter (the authors found that ammunition for a child's jet gun was ideal*); one ping-pong ball; one roll of 26 gauge wire; one jar of red airplane dope; one jar of blue airplane dope.

A base for the model was prepared by drilling a one-half-inch hole through the center of the six-inch-square board and inserting the dowel into the hole. A one-half-inch hole was cut through the ping-pong ball so that it would fit snugly over the dowel, and it was pushed to the center of the dowel.

Three concentric rings were made by bending the heavy wire into circles. These rings were attached to the dowel by inserting them in shallow grooves made at 45-degree angles to the base. They were securely fastened by wrapping them at the points of insertion with the 26 gauge wire. To give the model depth, the rings were placed on different planes to each other. The ping-pong ball, which serves as the nucleus, was painted blue. The plastic balls, to be used on the rings as electrons, were painted red. Grooves were sawed half way through the balls. By squeezing the balls at right angles to the cut, they were readily attached like clothespins to the wire rings. Thus it was found to be a simple matter to rearrange a dozen different kinds of atoms without interrupting the class discussion.

Molecular structure models. The authors have experimented with molecular models and believe that for high school science a highly satisfactory model can be provided at low cost. This requires the following materials:

> Four dozen of the same type plastic balls mentioned above; 50 pieces of three-sixteenth-inch dowelling, two-and-one-half inches long; six pieces of rubber tubing, three inches long, with inside diameter to fit snugly over the ends of the dowels; 12 pieces of three-sixteenth-inch dowelling, one inch long, to fit inside the ends of the rubber tubing.

Holes were first drilled in the plastic balls. To symbolize hydrogen atoms, one hole was drilled in each of 15 plastic balls; to symbolize chlorine atoms,

* Manufactured by the Knickerbocker Plastic Company, Inc., Glendale, California.

one hole was drilled in each of two balls; for oxygen, two holes were drilled more or less opposite one another; to represent any metal, three holes were drilled 120 degrees apart, on a great circle, in each of three balls. Next 12 carbon atoms were prepared by assuming that each ball was superimposed over an imaginary regular tetrahedron, with holes drilled at each of the vertices. Four plastic balls representing nitrogen, and one for phosphorus, had five holes drilled in each of them. Again it was assumed that each ball was superimposed over an imaginary regular tetrahedron, with four holes drilled at each of the vertices. The fifth hole was drilled by extending any one of the other four holes through to the opposite side of the plastic ball. Last of all, a ball with six holes was prepared symbolizing a sulfur atom, using a regular octahedron as a basis.

The balls were painted different colors to distinguish different kinds of atoms, and the chemical symbols were added in a contrasting color.

The pieces of dowelling served as single bonds and for that reason should fit snugly into the holes in the balls. The rubber tubing was used as flexible double bonds. The dowelling in the ends of the tubing was fitted into the holes in the balls.

All of the above visual aids were constructed at a total cost of less than three dollars. While these models served their intended purposes for the authors, they may require some modifications for other situations.

THE CUTTING EDGE OF SCIENCE

Recent Developments in Research and Technology

Census Reveals Farm Electrification Lagging

Figures now being released by the Bureau of the Census indicate that rural electrification is not as far along as the latest surveys of either REA or the electric utility industry have shown. Preliminary census information based on figures for 26 states indicates more than three-quarters of a million farms still without electric service. For the 26 states the census indicates 77.7 per cent of the farms do have electric service supplied by central stations. Figures range from a high of 94.6 for New Hampshire to a low of 54.8 in North Dakota. Only Maine, Utah, and Vermont of the states so far tabulated run ahead of REA estimates.

Tenth Semiannual Report of the AEC

Major activities in atomic energy programs January-June 1951 are reported in this volume. The U. S., it says, is second among the free nations in the production of uranium. It emphasizes that a major part of research in the physical and life sciences was directed toward finding solutions to health and safety problems, but that commensurate efforts were continued to broaden the base of our knowledge as a foundation for the future progress on which national security ultimately depends.

Examples of results in unclassified research are: *improvement in lead-uranium "clock"* by which age determination in rocks containing as low as one part per million of uranium is made by new method of isotopic analysis. *Solidification of He-3 for the first time,* accomplished by cooling to — 457° F. and applying pressure of 600 p. s. i. *More accurate measuring of mass of atoms,* important both in practical operations such as isotope separation and in the fundamental understanding of nuclear structure. *Metabolism in cows* is under study in several state universities, C-14 and P-32 being used to tag organic compounds that go into the building of milk sugar and fatty acids of milk. (For further information along these lines, see "We're Spending Billions on the Atom—What Are We Buying?" *Look,* Sept. 11, 1951.)

It is pointed out (p. 31) that the AEC plans to decrease and eventually liquidate its general fellowship program because "The AEC recognizes the need for this type of training, but feels that the type of training it previously sponsored can be administered by such an organization as the National Science Foundation. The National Science Foundation is beginning to develop a fellowship program for the academic year 1952-53." (In this connection, see *Editorial,* p. 183.)

Fruit-flies, Paramecia, and Evening Primroses

The Indiana University research program in genetics may yield more knowledge about many diseases, including cancer. Administered by three world-renowned geneticists, the program is now supported by grants totaling $100,000 yearly with the recent addition of $200,000 from Rockefeller Foundation for a five-year period.

Professor Hermann J. Muller (Nobel prize in medicine, 1946) uses drosophila, the ordinary fruit-fly, in his studies of the genetical effects of rays such as gamma and neutrons from radioactive substances.

Further evidence as to the heredity-controlling factors in the cytoplasm is sought by Professor Tracy M. Sonneborn. He and his co-workers have shown that cytoplasmic factors have many characteristics of genes, including the ability to mutate. Their work is done with the one-celled animal, paramecium.

Evolution in action—changes in the genes which are ultimately reasons for modifications in species—is the subject of studies by Professor Ralph E. Cleland. His researches make use of the evening primrose because of the peculiar way it passes genes from parent to offspring. Most evening primroses pass on to a given offspring the genes which they received from one parent only. Consequently, each plant carries the genes of only two grandparents instead of four.

Chips From the Cutting Edge

Not only what they do but the tiny quantity needed is an amazing feature of some of the new antibiotics. U. S. Dept. of Agriculture scientists report that a 19 per cent protein poultry feed with aureomycin added gives as good results as one with two per cent higher protein analysis. Proteins are high cost elements in mixed feeds. One experiment showed that to get this nutritional bonus it was necessary to add aureomycin at the rate of only 20 grams to a ton of the 19 per cent protein feed.

PRECIPITATES

Announcements, News, and Views of Current Interest

"Speaking of Rubber" is a 27-minute, black and white movie having as its central theme the importance of rubber in our daily lives. The movie is claimed as suited to use in grades six upward into high school. Free except for shipping fees; order from United States Rubber Company, Public Relations Department, 1230 Avenue of the Americas, New York City 20. A teaching guide and three illustrated booklets are supplied with film.

A suggestion: drop a post card to Young America Films, Inc., and ask to be placed on the mailing list for *YAF Close-Ups;* 18 East 41st Street, New York City 17. Several interesting new films and filmstrips mentioned in latest issue received.

A recent progress report on *The Point Four Program* indicates that within six months of first budget approval, about 350 PF technicians were at work on 108 technical cooperation projects in 27 countries. Some 35 foreign governments had asked the U. S. government for specific help in solving their problems through the PF program. The report (number six, May, 1951) discusses several specific problems in some detail. If interested to have a copy, write to the Office of Public Affairs, Department of State, Washington 25.

Statistical Circular No. 294 of the Office of Education, Washington 25, reports a *National Summary of Offerings and Enrollments in High-School Subjects, 1948-49.* Twenty-seven science courses are listed by title as given in grades seven through 12; enrollments and per cents are given. In the "standard" courses 1948-49 percentages compared to 1933-34 percentages are: general science, 20.8-17.8; biology, 18.4-14.6; chemistry, 7.6-7.6; physics, 5.4-6.3. All other subjects enroll 1.0 per cent or less of the pupils enrolled in the schools.

Massachusetts Institute of Technology and Harvard University have announced plans for a joint five-year program for the training of science and mathematics teachers for secondary schools and junior colleges. The course will lead to the degrees of B. S. in General Science from M. I. T. and M. A. in Teaching from Harvard. First two years will include the same program as taken by all M. I. T. students, after which a field of emphasis is to be chosen and professional education courses started at Harvard. Cadet teaching the fifth year will be supervised by faculty of Harvard School of Education.

The 1951 annual convention of the Central Association of Science and Mathematics Teachers will be in Cleveland, November 22-24, at the Hollenden Hotel. General, section, and group meetings are scheduled. Several outstanding scientists are listed as speakers. For information, write Donald W. Lentz, president, 3431 East 69th Street, Cleveland 27.

On November 8 through 10 the 29th Conference on the Education of Teachers in Science will convene at Ball State Teachers College, Muncie, Indiana. Many prominent science educators will participate. Dr. Robert H. Cooper of Ball State is president of the conference.

To obtain another interesting chart for your science classroom, write to Inquiry Bureau, General Electric Company, Lamp Department, Nela Park, Cleveland 12. Ask for a copy of the 25 by 33-inch, four-color "Tree of Light."

A manual on *Certification Requirements for School Personnel in the United States* presents the facts for each of the states and also provides a list of colleges and universities that are authorized by the various states to prepare teachers. A "must" for all connected with teacher training programs, the manual will also be of interest to many teachers. Order Circular No. 290 (Office of Education) from the Superintendent of Documents, U. S. Government Printing Office, Washington 25. Price 70 cents.

Congratulations to NABT on receipt of a grant in aid from American Nature Association to develop a project in conservation education. A three-year study will be undertaken to determine the present status of conservation education in the high school biology program and to prepare plans and some materials which would increase the emphasis. NSTA will be one of several national conservation and educational associations represented on the project's Advisory Committee.

Newest pamphlet published by the Public Affairs Committee, *Blood—Your Gift of Life,* was prepared by Alton Blakeslee, science writer for the Associated Press. Single copies, 20 cents. The address: 22 East 38th Street, New York City 16. Incidentally, congratulations to The Public Affairs Committee on completion of 15 years of educational services; we'll look for more, even better, pamphlets to come.

CLASSROOM ideas and demonstrations

Nucleonics

A Continuously Sensitive Diffusion Cloud Chamber

You or your students can build a type of cloud chamber that is actually used in nuclear research. Its development has been a spontaneous one that is being pursued by nuclear scientists at various institutions throughout the country. And yet this cloud chamber is simple enough for witnessing nuclear events in classroom demonstrations and experiments. It can be built at home of inexpensive materials.

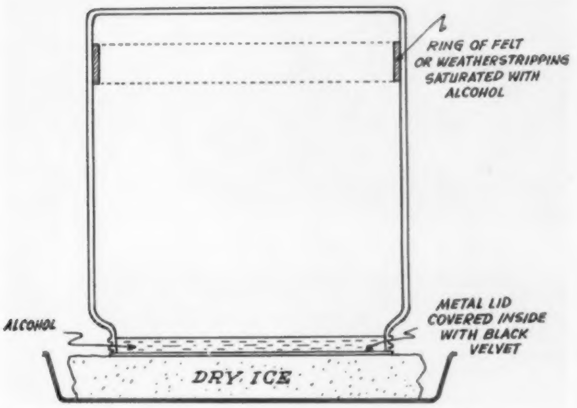
The principle of this cloud chamber is simplicity itself. A transparent glass vessel contains some alcohol. The vessel is sealed to maintain the desired atmosphere inside. The upper surface of the vessel is kept warm, while its lower or base end is kept quite cold, as by the use of dry ice. The idea is to have alcohol vapor continuously forming at the warm surface and moving downward so as to meet the "cold front" produced in the lower portion of the vessel. This causes the air within the vessel to become saturated, or supersaturated, with alcohol vapor. Then when cosmic-ray particles dart through this atmosphere (at speeds approaching that of light), tiny droplets of condensed alcohol form on the ionized particles produced along the paths of the cosmic rays. The atomic show goes on continuously as long as the evaporation and diffusion of alcohol is maintained. The display is best seen against a black background, as velvet, and in the path of a strong beam of light such as may be obtained with a home movie or slidefilm projector.

Now for further details and specific suggestions for building a chamber. Procure a large-diameter, low-form glass jar such as a *Skippy* peanut butter jar or a shaving cream jar. One having a metal lid with a rubber ring inside it or lined with a piece of waxed cardboard is preferable. A tall jar makes supersaturation of the atmosphere more difficult. Plastic jars and lids may be dissolved by the alcohol.

Remove the lid from the jar. Then attach a ring of *absorbent* felt, sponge rubber, or weather-stripping, by means of rubber cement, to the outer perimeter of the inside bottom of the jar; or, the felt may be cemented to the inside wall of the jar down close to the bottom. The felt should be about a quarter-inch thick, half to three-quarters of an inch wide, and quite absorbent. It should be cemented in place so as to leave most of the glass bottom of the jar available for viewing the tracks of nuclear and cosmic-ray particles.

Next, cement a disk of black velvet to the inside of the metal lid. Now pour alcohol (ethyl, or rubbing which contains iso-propyl alcohol) into the jar to a depth sufficient to cover the felt ring. Allow the felt to become saturated. Screw the lid on tightly, and your cloud chamber is ready for use.

Turn the jar upside down and set the metal lid-covered end on a slab of dry ice. Next, warm the glass end of the jar slightly with your hands



so that the alcohol in the felt vaporizes more profusely. The vapor will diffuse into the space within the jar and come into contact with the cold atmosphere resting on the metal lid.

Now aim a strong light source against the side of the jar and focus it, if possible, on the black velvet. Look into the jar—and you will see the tracks produced behind fast-moving cosmic rays. The tracks will vary in density, length, and direction according to the nature of the incoming particles.

Adjustments and patience may be needed, of course. Sometimes the tracks are best seen from one side or the other of the light, sometimes by looking down through the glass end of the jar.

It is also interesting to bring a source of mild radioactivity close to the jar, so that tracks produced by beta or gamma rays may be seen. An obvious source of such radioactivity is the dial of a watch or clock which has been painted with mildly radioactive materials. It may be discovered, too, that phosphorescent dials are not necessarily radioactive.

An inch-thick slab of dry ice should maintain operation for an hour or more. When the alcohol has evaporated from the felt ring, invert the jar so that alcohol again saturates the felt. Apply your hands to the glass end of the jar from time to time to supply the heat necessary to maintain evaporation of the alcohol.

With the principle of this cloud chamber firmly in mind, many modifications in design and construction seem possible. How about sharing your experiences with it with others?

This discussion is based upon information supplied by Associated Universities, Inc., Upton, New York. Suggested references are:

Nucleonics. February, 1951, pp. 82, 83. "Continuously Sensitive Diffusion Cloud Chambers."

Popular Science. March, 1951, pp. 210, 211. Kenneth M. Swezey. "How To See Cosmic Rays in Your Kitchen."

General Science

Five Years of Jet Racing

By ARNOLD A. KOHN, Science Chairman, Horace Greeley Junior High School, Long Island City, New York

You, too, can easily start a very exciting activity —jet racing—in your school. When the first contest was held in our school in 1947, only 12 jet models were entered. The number grew to 52 for the 1951 races. Among the entries were girls, as well as boys, from the seventh, eighth, and ninth years.

Almost any child can make a model jet racer. Patience and simple tools are the prime requisites, especially if a kit is used. However, many youngsters spurn kits and design their own models.

Long Island Sunday Press Photo.

The rear of the model is hollowed out so that a small cylinder of carbon dioxide—the kind used for charging soda water—can be placed in the cavity. When punctured with a sharp, spring-like mechanism, the gas streams out. Then, according to the third law of motion, the reaction force of the escaping gas propels the racer forward. A string stretched along the gymnasium floor and attached at the finish end to the leg of a chair acts as a guide line to keep the model on a straight path. The string must, of course, be slipped through screw-eyes screwed into the undersurface of the jet car.

In the beginning youngsters simply soldered wheels on the carbon dioxide cylinders, hoping the lightest would win.* To discourage the sacrificing of arts and crafts for speed and to encourage workmanship and originality, we decided to select the winner in the following manner. For a week before the contest all models are exhibited in a glass cabinet in the hall. Our principal judges all the models for design, and our arts and crafts teacher judges them for craftsmanship. A number, according to its order of excellence in each quality, is assigned to each model. After an inspection of the models, each is raced separately against time. A third number is then given according to its order of finish. The model with the lowest combined score comes closest to satisfying the criteria we established and so deserves the prize.

Recognizing the value of publicity to school morale, the art department cooperates in popularizing the jet races. The children use the jet races as a theme for poster work. Every year since 1947 the *Long Island Star Journal* has given us a half-page coverage of the event.

If *you* want to start an activity which sparkles with enthusiasm every year without fail, just try jet races. The "kids" will love it.

* Wasn't this dangerous? *Editor.*

Biology

To Show Mineral Matter and Cartilage in Bone

By DONALD SEWALL LACROIX, Science Department, Amherst High School, Amherst, Massachusetts

In the study of human physiology the question of bone composition can be easily demonstrated, as shown in the accompanying pictures, so that high school students will be very much impressed.

Photo by D. S. Lacroix

After about 36 hours in the acid, this bone becomes flexible because only cartilage is left.

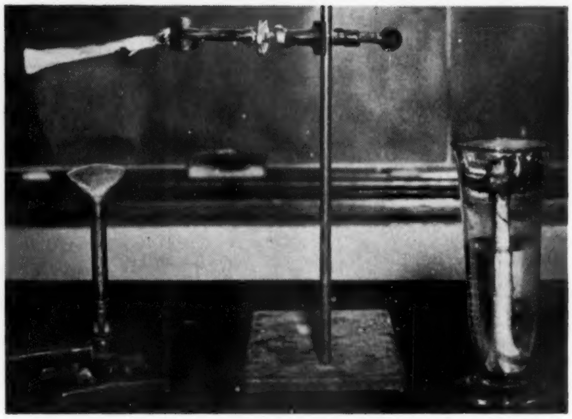


Photo by D. S. Lacroix

A set-up for burning a chicken leg-bone. This leaves lime. Bone at right is soaking in 20 per cent HCl to remove lime and leave cartilage.

Procure two bones of similar size such as the leg bones (drum-sticks) of a chicken. Clamp one to a ring-stand over a Bunsen burner. About an hour of this treatment will suffice to burn out most of the organic matter and leave white, brittle "lime."

Soak the other bone in 20 per cent hydrochloric acid for 24 to 36 hours. This will dissolve the mineral matter and leave the cartilage, so that the "bone" will now be very flexible.

General Science

A Natural Science Class Accepts the Challenge of Philip Morris!

By HAYM KRUGLAK, Department of Physics, University of Minnesota, Minneapolis

One objective of our general education science course is cultivation of the ability to read critically articles and advertisements in the popular press. The various cigarette advertisements are good examples of the "science-is-backing-us-up" style.

Clever advertising men have exploited to the utmost the popular cliche: science *is* truth. Their formula is simple. Show the picture of a distinguished-looking "scientist," appropriately or inappropriately attired in a white laboratory coat and surrounded by complicated apparatus; use as often as possible the words: science, scientists, doctors, specialists, laboratory tests, etc. The superiority of the advertised product is then established.

A recent advertising campaign ("WE DARE THEM ALL") by the manufacturers of the Philip Morris

cigarette was based on a test to be made by the smoker. The object of the test was to verify the statement that . . . "Philip Morris is definitely *less* irritating, definitely *milder*." The test, described in simple terms, provided an excellent opportunity for my natural science class to make a critical evaluation of the Philip Morris procedure. The outline of our science class project is given below.

1. Homework assignment—March 2, 1951
   a. Criticize the Philip Morris ad which appeared in the *Minnesota Daily*, March 1, 1951
   b. Devise an experimental procedure for testing the validity of the statements in the ad
2. Class discussion—March 5, 1951
   a. Good features of suggested test
      1) all subjects-smokers
      2) use of 2 brands
      3) actual trial by the consumer
   b. Shortcomings of the ad claims with respect to:
      1) sample selection of subjects and products
      2) natural conditions of smoking ("don't inhale")
      3) randomization of presentation
      4) bias caused by prior knowledge of brand and the expected conclusion
   c. Planning a more rigorous experimental procedure
      1) defining the test population
      2) devising a procedure for selecting a representative sample
      3) randomizing the presentation order
      4) defining judgment criteria
      5) standardization of test procedure
3. Class experiment—March 7, 1951
   a. All smokers in the class—15—wrote their name and cigarette brand on a card.
   b. The group was divided into two samples by the random number technique.
   c. Each subject was blindfolded, presented two cigarettes in succession, and given the test directions described in the Philip Morris ad. The subjects were not told the names of the two cigarettes.
   d. One sample—Philip Morris first, some other brand or Philip Morris second; the other sample —some other brand first.
   e. Each subject wrote out independently the answers to the following questions:
      1) Were the two cigarettes of the same brand or not?
      2) Were both or either your brand, and if so, which one was it?
      3) Which of the two cigarettes was less irritating?
   f. Results
      1) Two different brands presented to 12 subjects (Philip Morris was one of the brands)

Number aware of the difference	10
Number unaware of the difference	2
Subtotal	12

Two identical brands (Philip Morris) presented to 3 subjects

Number aware of identity	1
Number unaware of identity	2
Subtotal	3
Total number aware of similarity or difference	11
Total number unaware of similarity or difference	4
Total	15

2) Correct identification of subject's own brand . . . 6

Correct identification of subject's own brand	6
Incorrect identification of subject's own brand	9
Total	15

3)

Smoked Philip Morris first and found it less irritating	5
Smoked another brand first and found it less irritating	5
Smoked Philip Morris first and found it more irritating	1
Couldn't tell the difference regardless of the presentation order	4
Total	15

4) Concluding discussion

It was agreed that our test procedure was illustrative of a more valid method than that proposed in the Philip Morris advertisement.

The large proportion of subjects unable to identify their own brand of cigarette during classroom test was evident.

It appeared that the order of presentation of the two cigarettes might be an important factor in judging irritation. The concluding discussion brought out the fact that the test suggested in the Philip Morris advertisement was not capable of yielding reliable data about the relative merits of the products because of biased experimental design.

Physics—Aeronautics

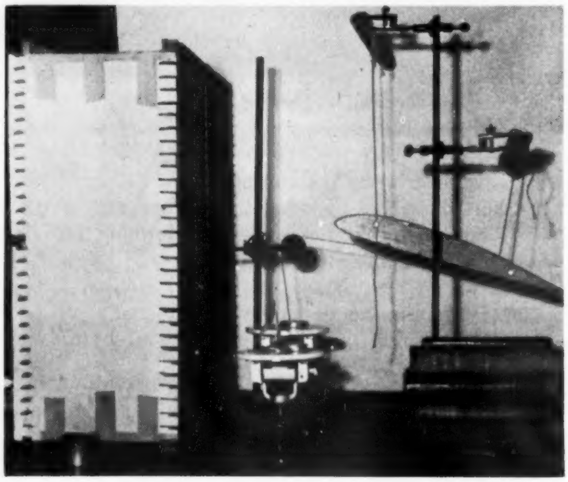
Building a Wind Tunnel

By CONRAD W. BATES, Physics and Aviation Instructor, Chattanooga High School, Chattanooga, Tennessee

Preflight aeronautics was introduced as a course in our school in 1942. We have continued it as a science course and have obtained much equipment, including Link trainers, from war surplus. The early classes met in the biology laboratory and were without funds to purchase equipment even if it had been available. It was decided to build

what equipment we could. All agreed that we would need some sort of a wind tunnel. Its construction, together with the building of scale model airfoils to be tested, became our first project.

A boy with a home workshop built two honeycomb sections each two feet square with openings one inch square. These were set up parallel to each other and one foot apart. The space between the sections was enclosed with a strip of cardboard. The honeycomb box thus formed was used to streamline the air.



Simply constructed from around-the-home-and-school material, this wind tunnel serves to visualize principles of aerodynamics.

Other boys plotted sections of Clark Y and NACA 23012 airfoils (the ones selected for study). From the drawings they prepared scale models with a chord length of about ten inches and a width of six inches.

Another boy loaned us a ventilator fan. Platform balances, ringstands, clamps, and pulleys were borrowed from the physics laboratory.

The equipment was set up as shown, and our wind tunnel was ready for operation.

Such equipment, though simple and somewhat inaccurate in performance, serves to stimulate interest in the subject and to demonstrate principles hard to visualize otherwise. With this equipment we are able to study:

1. The relation between lift and angle of attack.
2. The relation between drag and angle of attack.
3. The relation between drag or lift and airspeed.
4. Comparison of different airfoils as to lift and drag characteristics.

A copy of a student's experiment on lift follows.

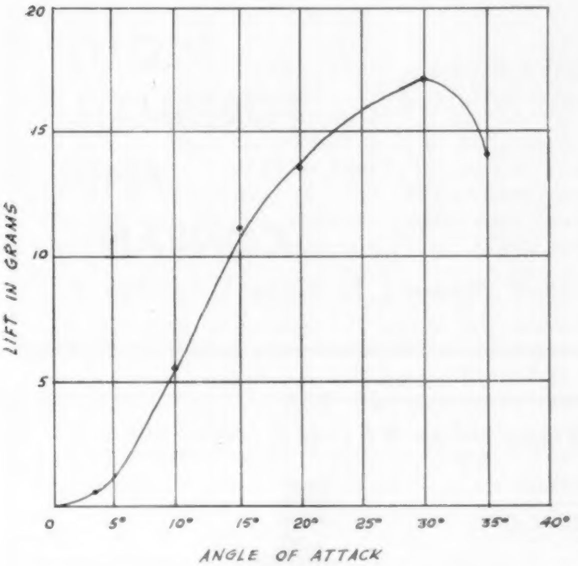
Aerodynamics-Lift

Purpose: To determine the lift of an airfoil at various angles of attack.

Procedure: Improvised wind tunnel using electric fan; suspended Clark Y airfoil from ring stand; measured amount of lift in grams on balance. Angle of attack was then increased and lift measured. This was repeated until the peak of lift or burble point was determined.

Data:

Angle of Attack	Lift
4°	.0.3 g.
10°	5.3 g.
15°	12.3 g.
20°	13.7 g.
30°	16.9 g.
35°	13.9 g.



Books Received

On the Origin of Species by Means of Natural Selection. Charles Darwin. (A reprint of the original edition.) 426 pp. $3.75. Philosophical Library. New York. 1951. Darwin's story as he first presented it to the world with an introduction by C. D. Darlington.

Let's Start Cooking. Garel Clark. 68 pp. William R. Scott. New York. 1951. An easy-to-read picture cookbook for children. Illustrations by Kathleen Elgin.

Philosophy for the Common Man. Heinrich F. Wolf. 189 pp. $3.50. Philosophical Library. New York. 1951. A discussion of basic philosophic problems, grounded in science and written by a practicing physician.

Embryology of the Viviparous Insects. Harold R. Hagan. 472 pp. $6.50. The Ronald Press Company. New York. 1951. A pioneer monograph designed as a text for the student entomologist, as a reference tool for public health and applied research workers, and as a source book for the professional entomologist or general zoologist.

NSTA Activities

Certain NSTA activities carried on during the past year have extensive and long-range implications for all science teachers. There are also other aspects of Association affairs which we thought should be reported in *The Science Teacher*. Accordingly we asked for "a few words" describing these activities, and here are the reporters' accounts. *Editor.*

Election of Officers for 1951-52

At the stroke of midnight, July 31, 1951, Ralph W. Lefler became retiring president and Arthur O. Baker, directing supervisor of science in the Cleveland, Ohio, public schools, began his one-year term as president of the National Science Teachers Association.

By vote of the members, Harold E. Wise, University of Nebraska, was chosen president-elect for next year and will head the Association in 1952-53. Hanor A. Webb, Peabody College for Teachers, was continued as recording secretary. Treasurer for 1951-52 is H. E. Brown, editor of educational charts, W. M. Welch Manufacturing Co.

Regional vice-presidents for 1951-52 are Richard H. Lape, *eastern*, Amherst Central High School, Snyder, New York; Dean Stroud, *north central*, Amos Hiatt School, Des Moines, Iowa; Greta Oppe, *southern*, Ball High School, Galveston, Texas; Miss Archie J. MacLean, *western*, Board of Education, Los Angeles California.

Regional directors elected to serve 1951-53 are Elra M. Palmer, *eastern*, Board of Education, Baltimore, Maryland, and Bayard Buckham, *western*, Oakland High School, Oakland, California.

Directors-at-large and years their terms expire are: Ira C. Davis (1952), University of Wisconsin, Madison; Hubert M. Evans (1954), Teachers College, Columbia University, New York City; Charlotte L. Grant (1953), Oak Park High School, Oak Park, Illinois; James G. Harlow (1953), University of Oklahoma, Norman; Philip G. Johnson (1952), U. S. Office of Education, Washington, D. C.; Norman R. D. Jones (1953), Southwest High School, St. Louis, Missouri; Elizabeth Lockwood Wheeler (1952), Maplehill, Mt. Pleasant, Michigan; Morris Meister (1952), High School of Science, New York City; Della J. Patch (1953), Hamilton Junior High School, Seattle, Washington; S. Ralph Powers (1952), Teachers College, Columbia University, New York City; Dorothy Tryon (1954), Redford High School, Detroit, Michigan; Stanley E. Williamson (1953), Oregon State College, Corvallis, Oregon.

S. R. Powers, *Chairman*
1951 Nominating Committee

The First National Thomas Alva Edison Institute for Science Teachers

Forty scientists, technologists, and science educators met for three days last May at Glenmont, the West Orange, New Jersey, home of Thomas Alva Edison, for discussions of effective and promising procedures for "making the most" of every individual's potential. The Institute for Science Teachers was sponsored by the Thomas Alva Edison Foundation with the cooperation of the U. S. Office of Education, the American Association for the Advancement of Science, and the National Science Teachers Association (see *The Science Teacher*, Vol. XVIII, No. 3: 169, April, 1951).

Those present were invited by the foundation with the thought that provocative discussion in small and informal groups would be helpful to science teachers who seek to provide, in the midst of mass education, an environment encouraging to the development of individual creativeness, discovery, and invention. Inspiring atmosphere for the talks was provided by the old home, its grounds, and all its Edisonia; by Mr. Edison's original laboratory and shop and by the museum maintained by the foundation. The invitees were welcomed by Mr. Charles Edison, son of the inventor and former governor of New Jersey.

Vice Admiral Harold G. Bowen, USN (Ret), executive director of the foundation, in delivering the keynote address referred to the present as the most provocative period in history. The role of the science teacher as educator in our industrialized society he likened to the pivotal role of the center on a football team. But he said that science teachers have to get out and do things for themselves; they can not wait, and society can not wait, for somebody else to provide all the elements needed for effective science teaching. This view accounted for the title of his address, "Operation Bootstraps."

Bowen referred to civilization as a vast revolving fund from which we borrow until we reach maturity. Thereafter, each should realize his individual responsibility for contributing to this revolving fund. The teacher must seek the way to bring about this maturity, this feeling of responsibility, in every individual.

Individual speakers and panel groups discussed such questions as these: 1. Why try to cover the syllabus? 2. How can a group of science teachers provide within their school opportunities and facilities for students specially gifted in science? 3. How can a teacher individualize instruction within a class group which may run to 35 or 40 or more in size? 4. How can each teacher be made to feel that each pupil has precious talents and thus seek ways for developing these talents?

5. How is reading in science to be encouraged? 6. How can teachers of science and of social studies work together toward better understanding of our industrialized society? 7. Since only one per cent of our population is classified as "scientist," how do we cause the great mass of people to understand the scientist, appreciate his methods, and cooperate intelligently with him?

Spirited discussion by the entire group followed each presentation—and not always with harmony and complete unanimity of viewpoints. Some important reactions were stressed, as for example: 1. It is a miserable waste of time to try to inculcate knowledge of facts only. 2. It is dangerous to have science taught by non-scientists, or teachers poorly prepared in science. 3. The science teacher must know enough of his subject to know how and when to keep quiet and not tell all the answers. 4. The freedom of thought, the value of human liberty, as illustrated by science which is itself above political and geographical boundary lines and which requires freedom in order to find truth, is an ultimate value. 5. The key to the whole problem of science education is the classroom teacher, the one who discovers and fosters and channels the talented youth.

RALPH W. LEFLER, *Retiring President*

School Facilities for Science Instruction

This study, initiated in November of 1950 under a grant to the National Science Teachers Association, is now well under way. The study is designed to provide substantial help to teachers, school administrators, members of state departments of education, school architects, and others who are responsible for the planning of science facilities in new and remodeled buildings.

The committee designated by the association to assume responsibility for the study planned that an initial report for review and criticism should be prepared on the basis of an agreed-upon general outline. An extensive survey of pertinent literature was made, and responsibility for the various chapters of the initial report was assumed by the committee members. The chapters so prepared were then edited and prepared for publication.

The first draft of the report was issued last July. It includes certain chapters of general nature. Among these are a discussion of the point of view of the study, planning procedures, general characteristics of science rooms, and audio-visual facilities for science teaching. Specific attention is then given to facilities for science in the elementary school and for general science, biology, chemistry, and physics in the high school. The multi-purpose room is considered separately. A chapter is devoted to the unique facilities of scientific and professional nature used by colleges and universities in the education of science teachers.

Concerns of the chapter on the planning of science facilities center upon the personnel of the committee responsible for planning science facilities, the procedures and techniques they may employ, and a kit which can be used to plan layouts for science rooms. The kit provides for a paper cut-out of the science room or rooms to desired sizes, with cut-outs of fixtures, furniture, and major pieces of equipment. Rooms can thus be planned with the arrangement of the facilities kept flexible during the process of planning. The cut-outs are so made that the projected facilities are represented in three dimensions.

Copies of the first-draft report have been submitted to many persons and reviewing groups for study and criticism. In the light of these criticisms and suggestions, the committee will reorganize and rewrite the first draft. The revised document will then be scrutinized carefully by a selected committee before final editing for publication. This part of the study will proceed during the late months of 1951 and the early months of 1952.

A significant contribution to the study has been made by more than 150 NSTA members who have reported their good and outstanding facilities for science teaching (in response to a questionnaire included in the February, 1951, issue of *The Science Teacher*). The ideas, features, and plans reported, as well as those facilities science teachers would like to have, are the subject of careful study by the committee.

Through cooperation of the Scientific Apparatus Makers Association, a Laboratory Planning File was distributed by a special mailing to members of NSTA. A second contribution of SAMA, via the packet service, is a leaflet prepared by members of NSTA describing and illustrating elementary school and high school science facilities. It is hoped that these two items will encourage science teachers to restudy their own facilities and to report to and advise the committee as to desirable qualities of the final report.

It is anticipated that the final report will be published in book form by the National Science Teachers Association, with certain portions utilized by the U. S. Office of Education for publication as a bulletin from that office.

Members of the committee are: *chairman,* Philip G. Johnson, U. S. Office of Education, Washington; *secretary* and *editor,* John S. Richardson, Ohio State University, Columbus; Arthur O. Baker (president of NSTA) ex officio, Board of Education, Cleveland, Ohio; Robert H. Carleton (executive secretary of NSTA) ex officio, Washington; William F. Goins, Jr., Hampton Institute, Hampton, Virginia; Helen E. Hale, Baltimore County Board of Education, Towson, Maryland; Ralph W. Lefler (retiring president of NSTA) ex officio, Purdue University, West Lafayette, Indiana; W. Edgar Martin, U. S. Office of Education, Washington; Henry A. Shannon, Department of Public Instruction, Raleigh, North Carolina; J. Albert Starkey, Vineland High School, Vineland, New Jersey; and Dorothea M. Wein, Middlesex County Board of Education, Princeton, New Jersey.

JOHN S. RICHARDSON
Committee Secretary and Editor

The Mills College Summer Conference

"Successful" is the word for NSTA's first attempt with a conference-type professional meeting with work sessions where all who attended had equal opportunity for participation in the study of problems of major importance to science teachers. Good attendance, excellent facilities, and an air of informal cordiality marked the five-day meeting at Mills College, Oakland, California, last June 28-July 2.

Kick-off was a conference on industry-science teaching relations, lead by Elbert C. Weaver, Phillips Academy, Andover, Massachusetts. William J. Long, U. S. Steel Company, reviewed the NSTA Advisory Council's activities and the formation of the Business-Industry Section. School assembly programs, charts, motion pictures, and pamphlets as provided by industry were discussed by G. M. Hayes, General Motors Corporation, C. E. Johnson, Westinghouse Electric Corporation, J. H. Sembower, Shell Oil Company, and William J. Long, respectively. J. E. Braslin of the Motion Picture Association discussed problems of educational film evaluation and utilization. R. H. Carleton reviewed the NSTA packet service and outlined plans for at least two fall distributions of 15,000 and 7500 copies. He pointed out that in about three years more than 150 titles from 90 different sponsors have been included in the packets. James G. Harlow, University of Oklahoma, countered by defining several problems which arise in the practical use of sponsored materials in science, and then went on to suggest several practical improvements.

In discussing "Reducing Time and Space in Science Education," E. Laurence Palmer of Cornell University doubted whether science teachers can make greatest contribution to society under present circumstances in fields of intense specialization if we are dealing with students below graduate level in universities; or in the direction that survey courses have been leading us. He suggested: a rational place between these extremes and science made functional along lines proposed for general education; adequate training in academic fields of science, as well as professional education, for those in charge of training science teachers; and more emphasis on semantics in our science work. The science class, he said, should go out and see things rather than try to settle matters by argument divorced from direct observation. He asked: Why cannot we see in a bit of lawn a laboratory for understanding the great grasslands of the world? Why cannot we see in a pool of water in an old tin or in an eavestrough a little aquatic laboratory?

G. W. Beadle, California Institute of Technology, discussed "The New Age of Biology." He said that genes appear to be irreducible elements of living systems capable of self duplication and mutation; life on earth probably first originated as a gene-like structure which through self duplication, mutation, aggregation, and natural selection gave rise to all subsequent living forms; and that genes are units of inheritance, function, and evolution of all presently known living systems including viruses, bacteria, higher plants, and animals.

Current "Challenges to the National Science Teachers Association" as seen by Dr. Philip G. Johnson, U. S. Office of Education, include: helping science teachers keep abreast of developments in an expanding scientific and technological society; assisting in meeting the rising demand for scientists and technologists; expanding services in preparation of practical teaching guides; and increasing membership since only 10 to 15 per cent of the science teachers are now members. We need, he said, a definite and forward-looking platform for action in order to facilitate exerting professional pressure in the interests of science and science teaching.

Work-study groups developed reports on these problems: 1. What are some good techniques for teaching science, particularly in moving toward individualizing instruction in large classes? 2. What methods can science teachers use to help pupils develop skill in problem solving and critical thinking? 3. How can we find out the needs and interests of children and society, and how can we develop a functional science program in terms of these needs? 4. How can traditional content be adjusted to newer trends in science education?

Copies of the complete report, *Proceedings Annual Summer Conference,* are available from the NSTA headquarters office (price 50 cents).

HAROLD E. WISE, *President-Elect*

Board of Directors Meeting

The NSTA Board of Directors met in four separate sessions; listened to committee reports, discussed, and deliberated for a total of 29 hours. Highlight actions taken: adopted budget for 1951-52; approved appointment of NSTA policies committee; commended editorial and business management of *The Science Teacher* and approved continuation of present policies; commended those responsible for program of cooperation with industry and approved continuation of Advisory Council, B-I Section, packet service, and related activities; approved continuing cooperation with Thomas A. Edison Foundation in any future Institutes for Science Teachers; thanked donors of grants for study of facilities for science instruction and commended the committee responsible for the study; approved appointment of a committee to continue film excerpt project in cooperation with Motion Picture Association and Teaching Films Custodians. Resolved: to study the matter of insurance coverage for teachers taking students on field trips; to express disapproval of the action of certain special interest groups in introducing legislation which weakens national defense and jeopardizes individual and public health and safety; to encourage science teachers to increase awareness of the menace of stimulants and narcotics; to commend the National Citizens Commission for the Public Schools for its vigorous and effective efforts in behalf of more widespread interest, enlightenment, and support of the public school systems of the United States of America.

A few copies of *Minutes, Annual Meeting, Oakland, California,* are available from the NSTA headquarters office.

HANOR A. WEBB, *Secretary*

NSTA Salutes American Chemical Society

In a colorful and historic event the American Chemical Society observed its Diamond Jubilee with appropriate ceremonies in New York City on September 5. James B. Conant, president of Harvard University, spoke as representative of all the participating scientific societies. Written greetings and salutations from NSTA were presented by Dr. Walter S. Lapp, retiring general vice president. Dr. Lapp, who has just been named head of the science department in Overbrook High School, Philadelphia, became a member of ACS in 1923 at the special invitation of Edgar Fahs Smith, then president of ACS and provost of the University of Pennsylvania. Dr. Lapp was also present at the 50th anniversary observance of ACS when a group assembled in Joseph Priestley's home in Northumberland, Pennsylvania.

The American Chemical Society with 63,000 members is the largest professional body of scientists in the world. Its 75th anniversary meeting was held in New York City September 3 through 7. In this connection "National Chemistry Week" was observed September 2-9.

Following the ACS meeting, the Conference of the International Union of Pure and Applied Chemistry convened, bringing together 200 representatives of 30 countries to reach agreement on atomic weights, names of elements, and other scientific matters of international concern. The final session of the International Congress of Pure and Applied Chemistry, which was held for the second time since the war, convened in Washington to participate in observing the 50th anniversary of the founding of the U. S. National Bureau of Standards.

Offices of the American Chemical Society are "just across the street" from NSTA and the Society's Division of Chemical Education is an affiliate of NSTA. Therefore, as would be expected, numerous opportunities and avenues develop for working together on problems of mutual importance.

ROBERT H. CARLETON, *Executive Secretary*

Greetings to ACS from NSTA

The National Science Teachers Association salutes the American Chemical Society on the occasion of its Diamond Jubilee. The science teachers are highly honored in being included in this colorful history-making ceremonial session.

The American Chemical Society is one of the leading scientific societies of the world in membership and influence. Many of the nation's science teachers are members of the society and many of our greatest teachers have been chemists. The American Chemical Society cooperates with many groups interested in the advancement of science education. The Divisions of Chemical Education and History of Chemistry through their programs and their official organ *Journal of Chemical Education* supply the educational needs of many science teachers. *Chemical and Engineering News,* the newsmagazine of the chemical world, is a constant source of up-to-the-week information on new developments in chemistry, engineering, industry, agriculture, and many other applied sciences.

These facts are mentioned because they are so closely related to the goals of science teaching at pre-college levels and in programs of general education. It is clearly the responsibility of the science teachers to discover the science-talented youth of America, to prepare them well in the basic sciences, and to guide them into suitable professions. Likewise, science teachers at all levels have the important task of achieving among the general citizenry a better understanding of the nature and methods of science and technology in the modern industrial state. The next generation of professional scientists and engineers is in the nation's elementary and high schools today. In these schools are also the great masses of tomorrow's citizens who by their votes and other opportunities to make decisions will help provide or deny the conditions conducive to the further advance of science.

The problems of providing sound and adequate science education for all are not yet solved; far from it. In facing these problems during the years that lie ahead, the nation's science teachers will be encouraged and strengthened by the cooperative support of the American Chemical Society.

WALTER S. LAPP
NSTA Delegate to ACS
Diamond Jubilee

September 5, 1951

BOOKS Review

Methods and Materials in Elementary-School Science. Glenn O. Blough and Albert J. Huggett. 310 pp. $3.75. The Dryden Press. New York. 1951.

Elementary-School Science and How To Teach It. Glenn O. Blough and Albert J. Huggett. 532 pp. $5.25. The Dryden Press. New York. 1951.

The second of these two books contains all the materials in the first and is an expanded edition which includes a survey of the necessary science subject matter. Hence the use of the expression "this book" in this review.

This book is a must for the beginning elementary teacher and a resourceful aid to the elementary teacher inexperienced in science. It has been prepared expressly for use in college courses that concentrate on the methods of teaching science.

A discussion of the place of science in the elementary school curriculum and of the objectives of science teaching are contained in Part I. There is an excellent discussion of science teaching aids and a suggested plan for organizing the science program.

Part II is devoted to suggestions on the teaching of specific science areas such as ancient plants and animals, the human body and how it works, the wind and the weather, heat and how we use it, atomic energy and its uses, magnetism and electricity, etc. For example, in the chapter, "The Human Body and How It Works," there are detailed directions telling how to conduct an experiment with white rats to show various nutritional effects. The book abounds with suggested experiments and projects. In the more comprehensive edition each of the "teaching chapters" is designated *B* and is preceded by an *A* chapter giving a survey of the science subject matter involved. Excellent illustrations and a well-selected bibliography are prominent features of the book.

It is this reviewer's opinion that any elementary school in which there is concern for science in the curriculum (and that ought to be *every* elementary school in the land) should have one or more copies of this book—not in the school library, but actively circulating among the teachers and being worn out from use. Moreover, secondary school science teachers who feel concern about *how* they teach *what* they teach —and *why*—would, in this reviewer's judgment, be tremendously stimulated and profited by an excursion into Blough and Huggett's book.

Raymond E. Trinter
Central High School
Columbus, Ohio

The Young Scientist. Maitland P. Simmons. 164 pp. $3.00. Exposition Press. New York. 1951.

A subtitle might read, "How To Maintain Good Discipline in Ninth-Grade Science Classes"—for this outcome would certainly ensue if any clever teacher used this volume earnestly. Thirty-five activities in 13 units are models of carefully organized forms of interesting, instructive demonstrations of science.

Organization—full, rich, satisfying—is the chief feature of the activities. First come introductory questions establishing a close relation to some interesting situaion. Then the activity is detailed with precise instructions and set-it-up-this-way drawings. Third comes comment on the observations taken "during the fireworks," with suggested modifications for repeat performances. Fourth, the interpretations; these comprise "street-corner questions" and many challenges for further discussion in and after class.

It will occur to any alert science teacher that these activities are superior show-offs of science for parents' nights, assembly programs, club projects, and booths at science fairs.

Some of us have had contact with the author for more than two decades. His enthusiasm for practical demonstrations in science is no sudden feature of his teaching. He has long been producing spirited lessons from dignified textbooks. We are glad that he has selected this list of choice activities and put them into print. We hope the deserved success of this volume will encourage him to further enrich our science literature for the sake of good discipline in ninth-grade classes, which will certainly follow whenever something of great interest is presented.

Hanor A. Webb
George Peabody College for Teachers

ANIMAL TOOLS. George F. Mason. 94 pp. $2.00.
THE APACHE INDIANS. Sonia Bleeker. 158 pp. $2.00.
GOLDEN HAMSTERS. Herbert S. Zim. 64 pp. $2.00.
THE GREAT WHALES. Herbert S. Zim. 64 pp. $2.00.
PLAY WITH VINES. Millicent E. Selsam. 64 pp. $2.00.
STATE BIRDS AND FLOWERS. Olive L. Earle. 64 pp. $2.00.
All these books are published by William Morrow & Company. New York. 1951.

MORROW does it again and again and keeps right on—producing top-flight junior books in science. This group of six new books, interestingly written by informed authors and beautifully illustrated, provides supplementary material (or core material, depending on your teaching habits) for science beginning as early as possibly grade two or three. The upper limit of usefulness can hardly be defined. For example, high school biology students, as well as second- or third-graders, can learn from Zim how to raise hamsters, and many adults will read Miss Bleeker's story of "raiders of the southwest" as avidly as a fifth-grade boy. That a mosquito, when he bites you, uses "tools" consisting of a pair of saws, two lancets, and two syringes will intrigue readers from about grade six upward, the way George Mason tells it.

Part of playing with vines consists of following directions for simple experiments which even third- or fourth-grade children can do. Zim suggests no experiments with whales, but second-graders can find out whether whales have hair, how deep they can dive, how fast they can swim, and other interesting facts from a beautifully illustrated book. Miss Earle's discussion of state birds and flowers, again nicely illustrated, would be a useful reference in upper elementary grades and in secondary school science classes.

We have only one regret about these fine books: the price tag. In competing with other books, equipment, and supplies essential or desirable in good science teaching, we fear that the $12.00 cost of these six, for example, not to mention others equally good and desirable, will greatly diminish the wide usage they truly deserve.

HUBERT J. DAVIS
Norfolk County Schools
Portsmouth, Virginia

Books Received

Johannes Kepler: Life and Letters. Carola Baumgardt. 209 pp. $3.75. Philosophical Library. New York. 1951. A biography of the father of modern astronomy with an introduction by Albert Einstein.

Chamber's Dictionary of Scientists. A. V. Howard. 499 pp. E. P. Dutton and Company, Inc. New York. 1951. Concise, up-to-date details of the lives and achievements of men of science from Chaldees to the present day scientists.

The New Physics. C. V. Raman. 144 pp. $3.75. Philosophical Library. New York. 1951. A discussion of such topics as water, soil, weather, atmospheric electricity, and structure of crystals for the layman.

OPPORTUNITIES IN ATOMIC ENERGY. Karl D. Hartzell. 144 pp. $1.00. Vocational Guidance Manuals. New York. 1951.

THERE IS no question as to the competency of Dr. Hartzell to write on career opportunities in the fields of atomic energy. In this little volume he measures up to what might be expected of him. The result will be useful to several categories of persons: high school and college students, vocational counselors in schools or industry, state or federal employment officials, and even those who are only "interested" in the atomic energy industry.

For the high school student, his science teacher, and his counselor, the most-likely-to-be-used chapter would seem to be number seven. This gives the personal, educational, and experience requirements for a large number of specific jobs which are described in some detail. Pages 126-131 are also likely to become well-thumbed since they deal with salaries.

Between the covers of this book is authentic information not likely to be conveniently obtained elsewhere right now. However, it will not be easy reading for the high school boy or girl; not that Hartzell hasn't used good, plain talk, but the student won't "breeze" through the book. This may be an advantage if they're really serious about a career in science.

Opportunities in Atomic Energy may be obtained directly from NSTA. Use the "Clip 'n Mail" coupon on the opposite page.

ROBERT H. CARLETON
Executive Secretary, NSTA

CAREERS IN CHEMISTRY AND CHEMICAL ENGINEERING. Walter J. Murphy, Editor. 94 pp. $1.00. Special Publications Department, American Chemistry Society. 1155 Sixteenth Street, N. W., Washington, D. C. 1951.

HAVE YOU ever desired direct counsel from practicing chemists and chemical engineers for your students? It is to be found in this publication. The authors of these reprints from a series appearing in *Chemical and Engineering News* present opportunities in: training for careers, research, business administration, chemistry for women, salesmanship, and many other areas. They present interesting and revealing personal touches so important in stirring up interest in the reader. The high school senior who has toyed with the idea of taking up chemistry as his life work will find this volume a concrete, well-elaborated answer to the question: "What is it like to be a chemist or a chemical engineer?"

In view of the national shortage of trained scientists and engineers, this volume should be an important addition to the library of science teachers and of particular value to vocational guidance counselors. It provides a wealth of knowledge which should be placed in the hands of all senior high school students interested in chemistry as a career.

KEITH C. JOHNSON
District of Columbia Public Schools

These "coupon service" pages announce the availability of free and low-cost business-sponsored teaching aids for science, all of which have been REVIEWED and APPROVED by the NSTA Evaluation Committee. To procure copies of desired items, fill out the corresponding coupons and mail these, together with any remittance required, to the NSTA Executive Secretary, 1201 Sixteenth Street, N.W., Washington 6. Watch these columns for additional offerings in future issues of *The Science Teacher*. (Print or type coupons.)

OPPORTUNITIES IN ATOMIC ENERGY. *Vocational Guidance Manuals.* Informational book covering all aspects of atomic energy and providing a wealth of vocational guidance information. See review, *The Science Teacher,* October, 1951, page 218, $1.00.

1951-52 TEACHING AIDS. *Westinghouse Electric Corporation.* A listing of 84 free and low-cost items: booklets, charts, transcriptions, scholarships, etc. Of special interest to science teachers are a new, four-color chart on turbojet engines, six transcriptions on "great names in science," and a new section on photography. The nuclear physics charts and other well-known science items are still listed. Free.

HISTORY OF COPPER, BRASS, AND BRONZE. *Copper and Brass Research Association.* Informational booklet well suited to use in general science and chemistry. Illustrations, some suitable for opaque projection. Free.

SCIENCE TEACHERS' GUIDE FOR WOOD EXPERIMENTS. *Timber Engineering Company.* Instructions and study questions for 18 experiments with wood. Useful for group activities and for special projects. Suitable for general science, biology, chemistry, and physics. Prepared in consultation with NSTA. Fifty cents a copy. (*Wood Study Kits,* including wood samples, manual, and special magnifying lens, $8.50.)

PARTS OF A DRY CELL. *Burgess Battery Company.* Cardboard chart picturing cut-away dry cell and showing relative position of each part. Also provided, information sheet on kit of raw materials for classroom construction of dry cells. Free. (Kit of materials for assembling 25 dry cells, $5.12.)

TIME TELLING. *Hamilton Watch Company.* A basic unit on the mechanics of a watch and how it works by Dr. Herbert S. Zim. Presents a comprehensive interpretation of Time Telling, its measurement and importance in our daily lives; stresses the role of watchmaking in the development of techniques for mass production. Teacher's manual, wall chart, and student lesson folders available to science teachers of grades 7 to 12 exclusively. Free.

THE BETATRON. *University of Illinois.* A booklet discussing the uses, development, and basic operation of the betatron. Excellent diagrams and illustrations. Free.

MEDICAL USES OF BLOOD—A MANUAL FOR SECONDARY SCHOOL TEACHERS. *American National Red Cross.* Report of committee of American Association for Health, Physical Education, and Recreation. Questions and answers on the composition and functions of blood and procurement and uses of blood as a medicine. Includes suggested student activities, suggested integrations, a brief quiz, and a list of resource materials. Free.

SAFE USE OF ELECTRICAL EQUIPMENT. *National Education Association.* Booklet for teachers, laymen, and students. Provides information, teaching suggestions, and quiz. Produced cooperatively by NSTA and National Commission on Safety Education. Special price to NSTA members only, 25 cents (50 cents to non-members).

(Coupons are on following page.)

Our Advertisers

Please send me .... copies of **Opportunities in Atomic Energy** at $1.00 each. (Remittance enclosed.)

Name..........

School..........

Address..........

Post Office.......... Zone.......... State..........

Please send me, free of charge, one copy of the **1951-52 Teaching Aids** catalog.

Name..........

School..........

Address..........

Post Office.......... Zone.......... State..........

Please send me .... free copies of **History of Copper, Brass, and Bronze.**

Name..........

School..........

Address..........

Post Office.......... Zone.......... State..........

Please send me .... copies of the **Science Teachers' Guide for Wood Experiments** at 50¢ each. (Remittance enclosed.)

Name..........

School..........

Address..........

Post Office.......... Zone.......... State..........

Please send me .... free copies of **Parts of a Dry Cell.**

Name..........

School..........

Address..........

Post Office.......... Zone.......... State..........

Please send me .... free copies of **Time Telling.**

Name..........

School..........

Grade.......... Number of Students..........

Address..........

Post Office.......... Zone.......... State..........

Please send me one free copy of **The Betatron.**

Name..........

School..........

Address..........

Post Office.......... Zone.......... State..........

Please send me .... free copies of **Medical Uses of Blood —A Manual for Secondary School Teachers.**

Name..........

School..........

Address..........

Post Office.......... Zone.......... State..........

Please send me .... copies of **Safe Use of Electrical Equipment** at 25¢ each. (Remittance enclosed.)

Name..........

School..........

Address..........

Post Office.......... Zone.......... State..........